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BUILDING THE MODERN SCHOOL

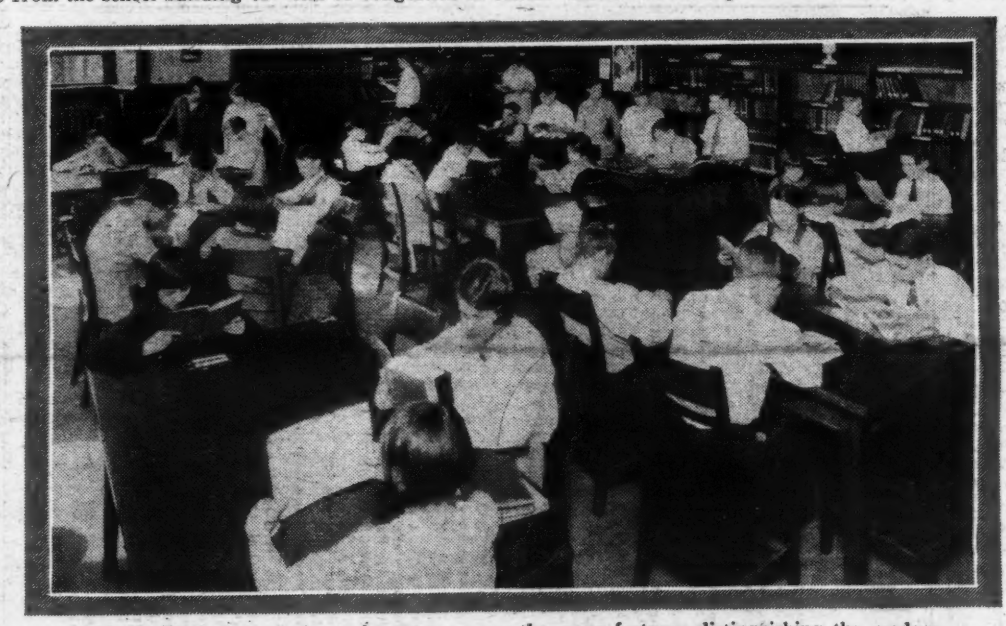
Designers and Erectors of Structures Are Meeting Demands for New Educational Facilities

By ALICE BARROWS
Specialist in School Buildings
United States Office of Education

THE planning and erection of school buildings is becoming a highly technical task which demands the combined knowledge and skill of educators, health specialists, building and landscape architects, and heating, ventilating, lighting, and sanitation experts.

The modern school building, which has been developed during the past 20 years, represents a radical departure from the school building of previous periods. Owing to changed social and industrial conditions which have deprived children in cities of many of the educational activities which formerly existed in the community life outside of the school, the curriculum of the modern school has been enriched so as to give children much greater opportunities than formerly for a variety of play, handwork, and social activities.

The school building has had to be changed to meet these new educational demands. At the same time advances in the science of heating, ventilating, lighting, and equipping school buildings are making it possible to prevent many of the health defects, i. e., bad posture, poor eyesight, respiratory troubles, etc., which developed in children as a result of the conditions in the older type of school building.



Libraries like the one shown here are among the many features distinguishing the modern school from its predecessors. Refinements of design and construction of school buildings necessarily accompany provision of these features.

BROADLY speaking, there have been three stages in the development of the school building, each of them the result of three important changes in our social and industrial life. In the early pioneer days life outside of school contained many activities of great educational value for children. There were crops to be planted and harvested and animals to be taken care of; cooking and sewing had to be done; and there was work with tools that developed mechanical ingenuity.

Man in those days had to live close to the elements and had to depend upon his own ingenuity in dealing with them. Children naturally shared these responsibilities with their fathers and mothers, and so developed a resourcefulness in meeting all kinds of situations which was of the greatest value in enabling them to become men and women equipped for their social group. For these reasons, it was not necessary for the school to teach anything more than the three R's. This in turn meant that the one-room schoolhouse of those days was adequate so far as school facilities were concerned.

The middle of the last century witnessed a fundamental change in American social life. This change had its origin in the rise of a city or urban civilization in contrast to a rural or agrarian civilization formerly in predominance.

Concentrated city life presented new problems to educators. However, so far as the change affected the educational system and the construction of school buildings, there have been two stages in school building development.

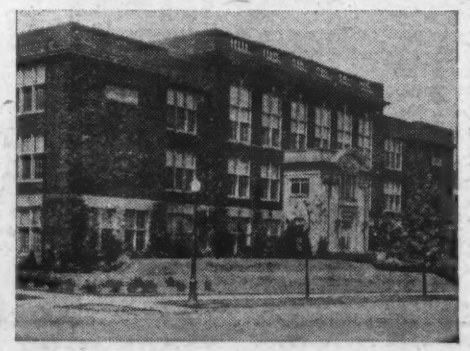
During the first stage, people as they flocked to cities retained their rural conceptions of education and school buildings. It will be recalled that those conceptions centered upon the one-room educational idea which is symbolized in the well-known red brick schoolhouse.

The only difference during the change was a readaptation of the old idea to meet the problem of congestion in cities. Instead of having the one-room building in detached independence, one building appeared to care for what was in fact 4, 8, and 12 one-room schools. A building merely housed a number of the old one-room schools of the rural civilization.

This was the period in schoolhouse planning known as the 1848 period. The buildings were usually three stories high, with large, high-ceilinged rooms, with no corridors, or else a "well" in the center of the building. As the science of lighting and ventilation had not yet been developed, children were forced to sit in rooms five hours a day under conditions that developed eye strain, bad posture, and bad respiratory troubles.

UNDESIRABLE as these physical conditions were, yet they did not constitute the most serious objections to this type of school. The real objection to it was that it was entirely unfitted to meet the needs of children living in cities.

The building itself usually was directly on the street and had little more than a small paved yard for play. The result was that more and more children took to the streets as their only playgrounds. Also, this type of building gave no opportunity for anything but the traditional study of the three R's, and in the growing cities of this period children did not find the opportunities for wholesome work and play which had been part of the life of children in pioneer days.



As cities grew in size and became so congested that all available vacant spaces were covered with apartment houses, factories, and tenements, it began to be clear that the school curriculum of a generation ago would not suffice for the modern city child; that the school must counteract the effects of city life upon children. The mounting record of juvenile crime and delinquency, and of deaths and injuries to children from playing in city streets, coupled with a greater vision and sense of social responsibility on the part of the educational group, has brought about radical changes in the educational program of the schools.

In the first place, it is now recognized that cities are not good places for children, first, because there are usually not sufficient spaces and opportunities for play. The need for healthful, wholesome play is one of the fundamental needs of childhood.

IN the second place, the city does not meet the fundamental needs of children because it shuts children away from contact with the actual, physical world. Each generation needs these contacts with the actual physical world for the sake of its own growth and for the preservation of the race. For human beings to shut themselves up in skyscraper cities and bring up generations of children on city pavements and in crowded apartment houses, to give growing children little or no opportunity for any first-hand knowledge of the earth's surface upon which we live, is a menace to the whole future welfare of the race.

Another fundamental need of children which is not satisfied by the city environment unless it is deliberately modified by the schools is the need of children to construct things. Children in cities no longer get the chance to take part in activities about the home or in community life which formerly were educational in character, for the reason that such activities are no longer carried on in the home. Economic changes have taken certain simple, fundamental educational activities out of the home, and neither optimism nor hope will put them back again. The modern city fails to give children the opportunity to create things with their hands which the simpler farm environment of a generation ago made possible.

Another of the serious problems of the education of children which has arisen out of the effect upon them of city environment is the use of their leisure time. Every father and mother knows what a real problem this is.

The investigations of the scientific student of social conditions are revealing some of the dis-

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CALIFORNIA'S LICENSE SYSTEM

Elimination of Irresponsibility in Construction Operations Is Aim of Western State

By JAMES F. COLLINS
Director, Department of Professional and Vocational Standards, State of California

THE further the State of California goes into administration of its law under which contractors are licensed, the more important it appears to be and the more obvious is its far-reaching effect upon building operations.

The act became effective on Aug. 14, 1929. At that time all contractors in California became illegal operators until they were licensed and registered.

Briefly, the law provides that every individual, firm, association, corporation, or combination thereof, who engage in or act in the capacity of contracting must be registered and have a license in California. The only limitation to this is that items of contracting less than $200 are considered incidental and inconsequential and, therefore, are not brought under the terms of the law.

It is a general consensus of opinion, however, that we will ask the next legislature to reduce this $200 limitation to $50, because the great trouble in the construction industry is caused more by the little fellow than it is by the big fellow; particularly that has been the experience of California. It is the little fellow who fails to carry compensation insurance, who takes a chance on the job, and who undercuts the prices. He sets the price for the big fellow and thereby causes himself a loss, causes his client a loss, and causes the industry a loss. So I shall recommend, trusting I may have the support of the organized contractors of California, that a $50 limit, or exemption, be placed in the law at the next legislature.

Definition of Term

The term "contractor" is defined in the act to be any one who does almost anything under contracting regulations. Just what the legal limits of the definition are remains to be found by the court's interpretation. But it is sufficiently definite so that at the present time we are requiring registration and licensing from every one who contracts to do anything about a building or a project. That includes the contract to furnish and lay the carpets on the floor, or linoleum, the shades and similar minor, comparatively minor parts of a building. Daily there is coming to my attention the question as to whether or not this item or that item is included. Until somebody proves us wrong, we shall require everybody to come under the law; standing upon our interpretation of the word "contractor" we are going to require that.

We have at this time built up our funds to a point where we are prepared to defend the law against court attacks clear through to the Supreme Court of the United States.

The law provides that a certified application must be made. This application is very simple, setting forth only the names of the owners of the firm, the style of doing business, a statement as to the general character of the business they do, their addresses, and the names of the officers, if it is a corporation, and the name of the responsible managing director, or what we would ordinarily call the general superintendent of the company. It must be signed by the proper authority of the company requesting the license and accompanied by a fee of $5.

Small Fee Charged

The fee is very small and we contend that it is more a privilege for the small contractor who may claim exemption under the $200 limit to be registered and recognized as a registered operating contractor in California than it is an obligation, or a burden, to pay the $5 that is asked. We claim that it is an actual privilege.

We have found a very fine response. As a matter of fact, it would not have been at all out of the way to have found 10 per cent of the recognized contractors of California in opposition to this program. But I am pleased to say that after almost six months of operation we have licensed about 16,000 contractors in California, and they are coming in at about the rate of 50 or 60 a day. We have not in our offices, either in the main office at Sacramento, or the branch office in San Francisco, or the branch office in Los Angeles, any record of any known opponent of the law. I consider that quite remarkable when consideration is given to the fact that here is the first step to attempt to regulate this great industry in a rather drastic manner. I refer to that drastic manner as it is designated in the law.

All the funds that are received from licenses under the act are allocated to the contractor's license fund and the act provides that all money in the fund is appropriated for the use of the registrar in carrying out the terms of the law.

Basis for Complaints

Under one of the sections it provides the basis for complaints under the law. It provides that any one may file a duly certified complaint, which means an affidavit sworn to before a notary public and properly prepared.

I am going to quote four paragraphs under which a complaint may be made, because they are the center of the law, you may say, and around these four paragraphs will resolve the good or evil that may be done:

"1. Abandonment of any contract without legal excuse."

In other words, if a contractor abandons a contract he goes into court, and if the court rules that he abandoned the contract without legal excuse, I am duty bound to cancel his license and put him out of business.

"2. Diversion of funds or property received under expressed agreement for the prosecution or completion of a specific contract under this act, or for a specified purpose in the prosecution or completion of any contract, and their application or use for any other contract, obligation or purpose, with intent to defraud or deceive creditors or the owner."

One of the great evils that California has suffered is the type of contractor who will throw all the necessary gambles into the deal and then add a few more, and figure if he can keep on robbing Peter to pay Paul long enough, he is apt to have a lucky streak some place and pull out of the hole. He has taken on one more gamble. He is either going to jail or he is going to have to leave the State in a hurry, because if he receives funds in payment for a specific part of his job, and he gives the owner a receipt for the payment for that part, and then fails to pay his labor and material bills for that particular job, he is then, under the law, diverting those funds with the intent to defraud. Because if he is unable to pay those bills it is evident that, unless he had the permission of the owner to pay that money some place else, he is defrauding the owner and the labor and material bill.

The first case, under that provision, recently came up in Los Angeles. On the evidence presented I suspended the license of an excavating contractor and gave him an opportunity to show cause why I should not cancel his license and make his retirement from the contracting business permanent, at least for one year.

Evidence in the Case

The evidence presented was this: He had taken a sub-contract to do certain excavating. He had then contracted with his truck man for so much a load. He received payment in full from the general contractor for the job, gave a sub-contractor, the truck man, checks that came back from the bank marked "No Funds." And when we checked them up we found his account had been closed. Now that man is out of business. If he attempts to do business any more we shall arrest him and take him into court, under the provisions of the act that makes it a penalty for operating without a license, a fine of $500 or six months in jail, or both.

The next cause for complaint comes under the following paragraph:

"3. Fraudulent departure from, or disregard of plans and specifications in any material respect without consent of the owner, or his authorized representative, or the doing of any willful fraudulent act for the licensee and contractor in consequence of which another is substantially injured."

Under that clause comes the problem which you heard discussed this morning, the problem of insufficient plans, the problem of speculation beyond reasonable limits in bidding. In order to attempt to help the contractor, and prevent him from unnecessarily exposing himself to complaint under that act, we have organized the elements of the construction industry, the engineers, the contractors, and the architects, into divisions in my department. The two boards representing the engineers and the architects are also under my supervision. And at a recent meeting in Los Angeles, attended by representatives of the three elements of the construction industry, we developed this thought:

It is the duty of the contractor who receives that character of plan not to bid on it and thereby perpetuate the error, but to submit a complaint to the proper board who licensed that man to do business and have him cited before that board to show cause why his license should not be cancelled for failing to live up to the standard of proficiency that the profession of architects or engineers should have. The same is true of the engineers.

That is what we seek to accomplish in California.

California's Department of Professional and Vocational Standards is composed of the Board of Registration for Civil Engineers, the Board of Registration for Architects and the Board of Registration for Contractors. It serves as a clearing house, bringing representatives of the three great elements of the construction industry together in monthly committee meetings which are successively held in various cities in the State.

Expression of Purpose

We have great hopes that through this Department of Professional and Vocational Standards we will make it so hard for the "trimmer" and the irresponsible contractor, engineer and architect to stay in business that he will find it more profitable to get out or else to come into line with terms of business-like efficiency, so that he will become a credit to the construction industry and a benefit economically.

We have had a number of cases among the contractors that we have been able to help. We might have put them out of business; we might have put them in jail, but it is not our policy to do that. We don't believe that this law can best be administered by drastic application of the police power.

We began with a program of education. We have had a number of instances where we have pointedly shown small contractors where their method of keeping accounts and their knowledge of their business was faulty, to the end that they have installed bookkeeping systems.

The construction industry is made up of three elements, the engineers, the architects and the contractors. It is obvious that no real progress, no lasting benefits, can come to the industry in a business-like way unless it comes by the uniform stepping up of all three at the same time.

In the past there has been, as I have experienced, this sort of a feeling by the people at large: That the contractor was considered a sort of a fellow who had a lot more gambling experience and "nerve" than good sense; that, as a rule, he wasn't overly honest and wasn't above trimming the other fellow; that he thought it was a good game to get in a room and try to outsmart the other fellow; and that the contractor was a sort of glamorous bandit who, if he thought he could "get away with something," would take a long chance.

On the other hand, the engineer and the architect were considered a

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ROAD SPECIFICATIONS IN REVISED FORM

By FRANK T. SHEETS
Chief Highway Engineer, State of Illinois

REVISION of its standard specifications for road and bridge construction has just been completed by the Illinois division of highways, and copies now are being sent to district engineers, contractors and material producers.

Bids to be received by the State on Apr. 11, the first road letting of the 1930 season, will be based on these new specifications.

As now modernized, the specifications represent the best engineering practice in effect today. Methods and policies adopted by the Federal Bureau of Public Roads, the American Association of State Highway Officials, the American Society for Testing Materials, and other nationally known engineering societies have been followed wherever applicable to Illinois, and the findings from extensive scientific research work conducted by the Illinois highway department have been applied also.

The most important change in the construction policy is the adoption of the weight method of proportioning concrete aggregates. It represents a decided step forward in securing uniformity of strength and quality of concrete.

Its adoption has made it necessary to develop a scientific design of the concrete mixture, and the division of highways has worked out a method which is based on data compiled at the University of Illinois by Professors A. N. Talbot and Frank T. Richart, nationally known concrete engineers.

This new concrete mixture will be used on all State bond issue roads, as well as on the secondary roads of concrete, or brick surface on a concrete base, and in constructing all concrete bridges.

All Types Included

All types of road surfacing and incidental materials suitable for secondary, or county road, construction are also included in the new specifications.

These secondary road types were included for the guidance of the counties in expending the portion of the revenue allotted to them under the motor fuel tax law.

The specifications include the following types of surfaces:

Oiled earth, sand-clay and top-soil, traffic bound gravel or crushed stone, waterbound macadam, bituminous surface treatment, bituminous penetration macadam, bituminous concrete, sheet asphalt, and rock asphalt, portland cement concrete and brick.

For the benefit of the counties, specifications also were added to cover several different types of culverts, such as corrugated galvanized metal, vitrified clay, reinforced concrete and cast iron culvert pipe.

A ROAD THAT WILL BE FAMOUS

Highway to Be Built as Memorial To Nation's First President

By THOMAS H. MacDONALD
Chief, U. S. Bureau of Public Roads

WORK has just been begun on a 15-mile stretch of highway in Virginia which is to reach from Washington to Mount Vernon, the revered estate of the Nation's first President. Compared in length with the great arteries of traffic brought into being during recent years, the new road will be a mere midget. And the highway engineering problems involved in its construction will not be considered especially intricate. But, traversing ground that was historic even before the Revolution, and standing as a memorial to the Nation's founder, it is destined to be the most famous bit of road building ever undertaken by the Federal Government.

Symbol of Sentiment

Symbolizing the finest patriotic sentiment, the road will be dedicated on Feb. 22, 1932, in connection with celebration of the two-hundredth anniversary of the birth of George Washington.

The highway will be built on a right of way 200 feet in minimum width which parallels the scenic Potomac River. Its design calls for long easy curves and grades that will rise and fall gently with the natural roll of the hills.

Grade separation structures, graceful in design and featuring liberal approach connections, have been planned to give assurance against congestion of traffic. Grade crossings are almost entirely eliminated under the plans; where they are inevitable, as in the City of Alexandria, "full-stop" boulevard regulations will be established. At points where minor roads will join the highway, flared or widened sections will be built. The fullest ingenuities of traffic engineering will thus be brought into play to afford safe and easy progress along the road.

The highway will cross five estuaries on hydraulic fills and bridges. At intersecting roads there will be three underpasses and two overpasses. The bridges are simple and dignified in design, with plans calling for reinforced concrete arches, faced with native stone laid in random bond.

Provision for Parking

At Mount Vernon, provision will be made for parking 350 passenger cars and 60 busses in formal arrangement at one time, a unique terminal design making this possible.

Actual construction work began in October and November, 1929, when two hydraulic dredges owned by the War Department and operated under the direct supervision of the United States Engineer Office of the War Department began pumping sand and gravel into fills along the route. This work, still in progress, is well advanced. The first contract awarded was for the construction of rip-rap foundation walls for the fills.

The entire project is being financed by a special congressional appropriation of $4,500,000 included in legislation authorizing the George Washington Bicentennial Commission, created in 1924, to take the necessary steps to construct a suitable memorial highway. This legislative action was taken on May 23, 1928, and also authorized the Secretary of Agriculture to cooperate with the Commission in the construction of the highway. The Secretary in turn delegated the making of surveys, plans and specifications, and the working out of all details involved in the actual construction of the thoroughfare to the Bureau of Public Roads. The Commission, however, determined the route.

The Commission, created by Congress on Dec. 2, 1924, is headed by the President, as chairman, and consists of four Senators, four Representatives, eight citizens appointed as Commissioners by the President, and four ex-officio Commissioners—the President, Vice President, Speaker of the House, and an executive secretary. Senator Simeon D. Fess, of Ohio, is vice chairman of the Commission.

The work now being undertaken represents culmination of more or less sporadic plans covering four decades. The Virginia Legislature gave incorporation papers in 1888 to the Mount Vernon Avenue Association, an organization formed with the intent of building the road. The Virgina Legislature also gave its approval to provisions for transfer of a claim held by the State against the Federal Government. The money to be available in this manner was to go to the association.

Under the association's plans, the road was to be 60 feet wide, with 70 feet to be allowed on each side for landscaping. It was proposed that one mile of the right-of-way be allotted to each of the 13 original States so that each of those States might have an opportunity for special memorializations.

An act of Congress in 1889 provided authority for surveys and reports on three alternative routes, one of which closely approximates the route which the highway now is to follow.

Steam shovels began grading operations in the Mount Vernon approach area Mar. 18. This work was begun on that part of Washington's estate that he willed to his nephew, Judge Bushrod Washington, son of his brother, Augustine.

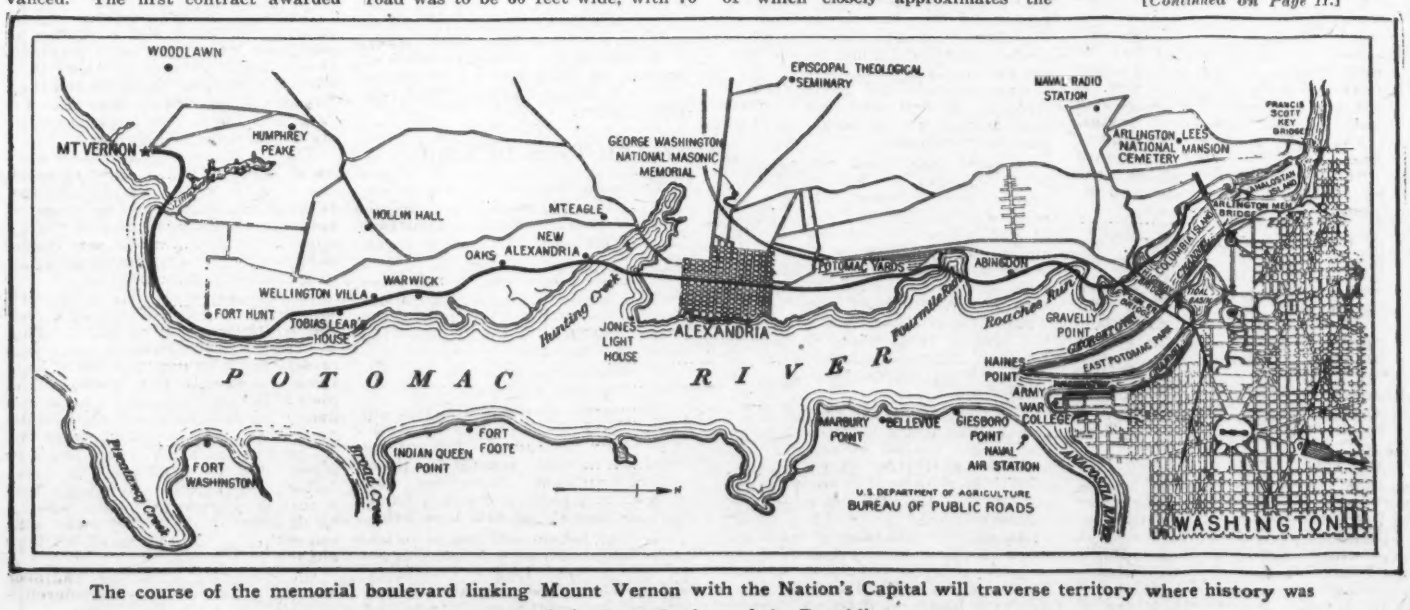
The growing movement for retention of natural beauty along highways will make broad advance as a result

[*Continued on Page 11.*]

Henry Miller

Hugh Miller

Unique views of early construction operations on the Mount Vernon Memorial Highway are shown here. The photograph reproduced above was taken at the moment an old bridge on the route was destroyed by dynamite explosion to make way for the artistically designed structure which is to replace it. At the left is shown the beginning of dredging operations at one of the many points where the new highway will come close to the waters of the historic Potomac River.



The course of the memorial boulevard linking Mount Vernon with the Nation's Capital will traverse territory where history was made in the early days of the Republic.

COST OF RECLAMATION PROJECTS

Outline of Federal Expenditures Provides Basis For Engineers' Future Estimates

By W. F. KUBACH
Chief Accountant, U. S. Bureau of Reclamation

WHAT is the Government's investment in Federal reclamation? What is the construction cost of this or that project? The foregoing are two of the more frequent questions which confront the accountants of the Bureau of Reclamation.

In the article appearing in the February, 1930, issue of the Bureau's official publication, New Reclamation Era, under the head of "Accounts and Finance," the Government's contribution to the reclamation fund on June 30, 1929, is stated as $147,714,305.92. This amount, together with direct appropriations out of the General Treasury of $5,393,312.35, and the unpaid balance of $11,000,000 of the special loan to the reclamation fund—in all, $162,107,618.27—constitutes the Government's aid or investment for the reclamation of arid, semiarid, swamp and cut-over timber lands under the direction of the Bureau of Reclamation. The accepted economic definition of capital investment is that portion of wealth set aside for the production of additional wealth.

Important Facts

In determining the character of accounting data required it is equally important in Government activities where the construction of public works is involved that expenditures should be known in terms of work done and activities, as well as in terms of funds, resources, other assets, and balances. This is especially true in the Bureau of Reclamation, where the amounts expended are repayable by the beneficiaries, and to apportion equitably the capital outlays or construction cost among the several divisions, districts, etc., of a project, intricate allocations of the costs of joint or common storage, irrigation, drainage and other features are necessary.

The revolving features of the reclamation fund make possible the construction of projects the total cost of which exceeds greatly the $162,000,000 set aside by the Government for the investigation, construction, and operation and maintenance of reclamation projects, as shown by the accompanying statement. Every dollar invested in one project upon repayment is available, upon authorization from Congress for the investigation and construction of another project, or for continuation of the construction, operation and maintenance of the same project. The reclamation law permits the contribution of money by States, municipalities and other organizations for investigations, construction, etc. Where no investment of the Government is involved, it is essential that the work accomplished be expressed in terms of construction cost.

Cost accounting is therefore a very important feature of reclamation accounting. It serves a threefold purpose—(1) detail information of the elements which make up the cost of classes of work or features, which can be made available as the work progresses; (2) detail information of the elements which enter into the cost of a reclamation project, available to the engineer in estimating the cost of new work; and (3) a record of results by divisions, districts, units, and features to serve as a permanent historical record of the cost of the project and permit an equitable apportionment of the capital outlay, as the interests of the several divisions, districts, and units may require.

Cost Accounting System

The capital outlay for the construction of each project is obtained by a standard system of cost accounting. The construction cost is assembled under 12 principal features, defined as follows:

(1) Examinations and surveys.—The cost of reconnaissance, investigation of water supply, soils, trial surveys, borings, estimates, etc., for the purpose of determining the feasibility of the project as a whole, and all expense of a general nature not properly applicable to a definite physical feature.

(2) Storage system.—The cost of all works incidental to the storage of water.

(3) Pumping for irrigation.—The cost of all works to develop water by pumping, either from underground wells or open streams.

(4) Canal systems.—The canals and structures used as main distributaries or feeders.

The Lateral System

(5) Lateral system.—The cost of the smaller distributaries and structures for the final application of the water to the land. The distinction between canal system and lateral system is more or less arbitrary, and will depend greatly on the particular conditions on the project and the judgment of the project superintendent. No definite line can be drawn, but as a general rule the main feeders only will be included under canal system.

(6) Drainage system.—The cost of drainage. This should be distinguished from wasteways intended for the control of water deliveries and a protection of irrigation works and from waste-water ditches for disposing of surplus water wasted by irrigators. The latter is a proper charge against the canal or lateral system.

(7) Flood protection.—The cost of levees, dikes, or other works designed primarily to protect lands or works from floods.

(8) Power system.—The cost of permanent power development.

(9) Irrigable lands.—The cost of farm units, survey of irrigable areas, ownership plats, and work incidental thereto.

(10) Permanent improvements.—The cost of works utilized for general purposes, such as headquarters office, experimental farms, roads, permanent buildings, real estate not properly classed as right of way, etc.

(11) Telephone system.—The cost of permanent telephone installation. This does not apply to a telephone line erected only to facilitate construction work. The latter is a plant facility and should be charged to telephone plant account.

(12) Operation and maintenance.—A separation will be made of the cost of operation and maintenance during the construction period and under public notice and reported separately on the principal feature cost report and monthly balance sheet; but the method of assembling cost and the items to be kept will be the same for all work of operation and maintenance.

The accompanying tabulation shows the construction cost of each project classified by the above principal features.

Work on Capitol in Atlanta

CONTRACTS for the remodeling of the Georgia State capitol building have been awarded by Governor L. G Hardman, according to his recent announcement. Remodeling operations were to be started immediately and to be completed within six months, he stated.

The contracts call for the construction of several new suites of offices on the ground floor of the capitol; installation of two new elevators; and the provision of apparatus to improve the acoustics in the chambers of the State senate and house of representatives.

Under the general remodeling contract the capitol will be rewired throughout, indirect lighting will be installed and the ventilating system will be thoroughly overhauled.

An appropriation of $250,000 was made by the 1929 legislature to remodel the capitol building and purchase a parcel of adjacent real estate on which an annex may be erected in the future; $55,000 has been spent for the latter purpose.

Construction Costs of Reclamation Projects by Principal Features to June 30, 1929.

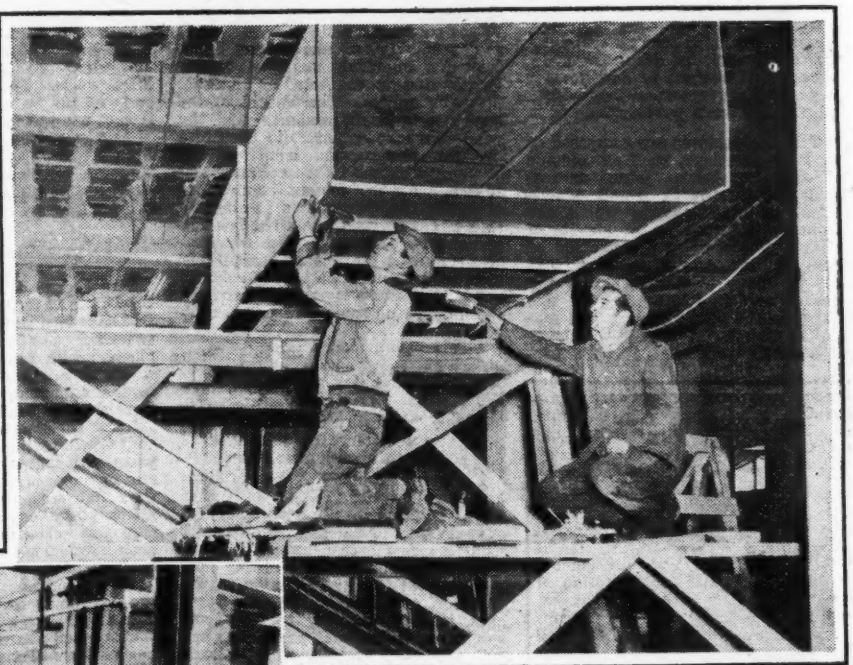
State and project	(1) Examination and surveys	(2) Storage: Storage dams	(2) Storage: Other storage features	(3) Pumping for irrigation	(4) Canal system: Diversion dams	(4) Canal system: Canals	(5) Lateral system	(6) Drainage system	(7) Flood protection	(8) Power system	(9) Farm units	(10) Permanent improvements	(11) Telephone system	(12) Operation and maintenance during construction	(13) Miscellaneous	Total
Arizona: Salt River	$83,939.53	$2,800,187.00	$201,765.25	$167,306.38	$793,940.27	$2,148,407.02	$620,071.25	$7,673.00		$3,820,713.12	$31,022.53	$763,686.17	$69,734.13	$2,362,719.51	[1] $145,677.84	$15,166,942.10
Arizona-California: Yuma	225,722.77				2,101,374.00	1,458,470.10	3,501,428.00	708,809.87	$2,729,739.60	817,936.09	32,208.21	205,620.76	14,822.98	724,585.50		10,075,487.60
California: Orland	5,935.90	1,201,885.95	468,212.51		37,000.00	189,688.11	433,209.87		490.72		1,260.59	15,314.19		107,657.22		2,800,769.17
Colorado: Grand Valley	73,945.20			102,632.51	495,466.99	2,968,087.00	354,071.29	684,680.50	13,577.77	[1] 360.00	40,261.84	22,469.10	11,784.38	557,927.34	[1] 498.64	5,320,169.37
Uncompahgre	995,541.76		[2] 12,008.92		178,308.00	3,882,542.71	2,218,860.88	3,940.63		[1] 278.88	39,302.88	31,968.52	6,788.48	1,490,884.06		7,928,760.97
Idaho: Boise	212,015.09	4,996,388.00	484,222.23	139,439.39	1,606,071.00	2,822,780.54	2,712,230.57	1,027,363.73		694,669.80	47,732.99	157,220.07	44,062.76	1,079,208.13	[1] 13,881.48	15,660,093.97
King Hill	228,798.09					1,870,823.94	248,684.57				4,799.97	34,631.46	5,202.77		[1] 3,849.84	1,995,318.80
Minidoka	170,984.65	1,131,925.00	147,220.50	832,108.08	625,541.00	1,224,040.48	1,117,984.16	704,224.86		995,535.53		146,796.48	23,396.01	830,353.90	[1] 4,286.25	7,249,906.39
American Falls		2,845,521.97	4,495,554.82							292,978.17				9,000.00		7,644,054.96
Gravity extension unit	40,401.96					[3] 33,999.96										374,441.92
Kansas: Garden City	7,618.72			110,743.74		83,646.17				123,993.69	285.06	7,548.12		52,868.10	[1] 4,227.58	395,831.78
Montana: Huntley	5,944.19			144,990.88		694,150.84	408,272.72	323,411.97			18,376.18	17,438.39	8,773.01		[1] 16,948.91	1,842,302.99
Milk River	214,916.27	1,028,744.00	85,330.29		787,916.00	2,256,768.91	1,008,200.96	27,766.93	58,252.94	[1] 445.60	24,982.29	81,311.12	23,007.82	235,839.64		6,006,136.62
Sun River	61,534.12	2,422,948.96	280,998.84		149,300.00	2,482,418.96	1,027,268.18	189,906.00								
Montana-North Dakota: Lower Yellowstone	962,643.35			99,970.93	408,231.00	2,089,669.14	451,169.80	341,088.19			2,008.49	40,096.36	22,818.22			3,437,096.45
Nebraska-Wyoming: North Platte	42,785.82	4,428,960.00	492,179.14		307,062.00	7,943,088.33	3,670,662.99	1,421,144.54		878,973.11	74,624.30	117,510.21	49,657.73	1,001,280.74	[1] 136,760.71	20,164,425.62
Nevada: Newlands	458,198.97	1,484,718.00	215,048.26		226,048.00	2,168,189.12	1,585,928.30	1,044,343.22	131,821.37	334,795.52	117,766.32	118,319.27	42,612.45		[1] 40,808.80	7,966,630.60
New Mexico: Carlsbad	41,084.59	547,353.00	173,427.19			347,524.28	70,181.17	129,705.87				155,249.50				1,464,522.57
Hondo	4,422.70	154,844.67				93,898.66	38,979.34				19,837.41	23,338.45	4,170.42	42,081.71		381,573.30
New Mexico-Texas: Rio Grande	161,067.18	4,415,267.00	804,396.53		352,269.00	3,049,102.38	2,209,774.35	3,410,547.70	5,995.34		228,288.99	68,532.20	11,773.29	863,217.49		15,080,226.41
North Dakota: North Dakota pumping	34,098.44						171,349.37			274,387.87		23,019.48	14,774.98			517,630.09
Buford Trenton							58,495.83			159,166.19		5,560.13				223,422.06
Oregon: Baker	62,474.85		[2] 5,659.48													68,334.33
Owyhee	1,298,949.55	518,961.32	[2] 332,960.17			10,053.57						9,178.15				1,690,109.74
Umatilla	115,210.70	2,344,665.00	647,288.58		71,625.00	874,701.85	989,854.97	119,038.75			3,375.08	33,389.85	2,772.57		[1] 5,851.09	5,176,914.15
Vale	593,781.27	251,067.32			38,384.00	866,678.61	12,336.94									1,305,251.04
Oregon-California: Klamath	176,215.99	449,320.00	268,849.55	31,861.11	282,255.00	2,410,874.74	741,295.18	855,552.04	77,019.18	127,357.01	14,320.95	37,323.83	36,414.05	117,170.78		5,615,033.71
South Dakota: Belle Fourche	14,351.53	1,230,922.00	577,068.02			992,700.00	734,346.17	257,635.70			12,141.36	40,970.86	14,883.07			3,885,320.21
Utah: Salt Lake Basin	73,483.92	571,820.20	763,718.77													1,399,028.90
Strawberry Valley	48,658.27	406,501.00	[1] 2,292,706.46		39,666.00	775,099.96	708,402.92				90,060.50	9,025.68	115,223.25	14,061.19	12,511.90	[1] 7,689.27	3,519,935.39
Washington: Okanogan	4,403.27	629,159.00	138,833.24	155,965.24	4,140.00		431,664.24					1,889.92	74,506.90	6,678.10	4,736.30	[1] 4,259.40	1,456,466.67
Yakima	355,342.42	6,354,927.42	[1] 382,311.15	398,401.12	79,901.00	2,945,419.53	2,480,088.23	11,418.80				72,402.15	329,599.61	83,040.31	10,206.84	[1] 28,861.58	14,452,110.96
Yakima-Kittitas	136,846.30			[1] 270.33	137,392.89	4,555,613.85	76,816.14					84.97				4,907,003.47
Wyoming: Riverton	109,062.90	277,990.00	81,787.21		497,012.46	1,807,129.43	476,462.72	20,216.48				25,996.00	22,836.41	26,820.44	17,024.03	3,372,606.68
Shoshone	90,571.01	1,495,139.00	907,664.11		450,410.00	2,689,203.30	1,218,356.49	2,376,672.45		681,950.04	70,388.48	77,647.12	24,446.84	34,874.39	[1] 8,089.52	9,612,518.75
All States Secondary	2,395,573.00															2,395,573.00
Subtotal	5,794,211.50	49,189,308.87	14,326,810.97	[1] 824,635.71	9,599,793.19	65,903,264.60	27,867,504.79	13,780,902.08	3,017,215.92	8,715,618.00	991,201.45	2,990,141.22	893,723.86	9,723,783.22	418,693.13	198,706,698.51
Arizona: Yuma auxiliary	33,730.21			159,936.24		271,227.47	326,507.43		9,020.00	9,749.34	837.00	64,958.48	422.16			875,394.43
Total	5,827,941.71	49,189,308.87	14,326,810.97	[1] 984,571.95	9,599,793.19	66,174,492.07	28,193,912.22	13,780,902.08	3,026,235.92	8,725,367.34	[4] 992,038.45	[5] 3,055,099.70	894,145.72	9,723,783.22	418,693.13	[6] 199,582,092.94

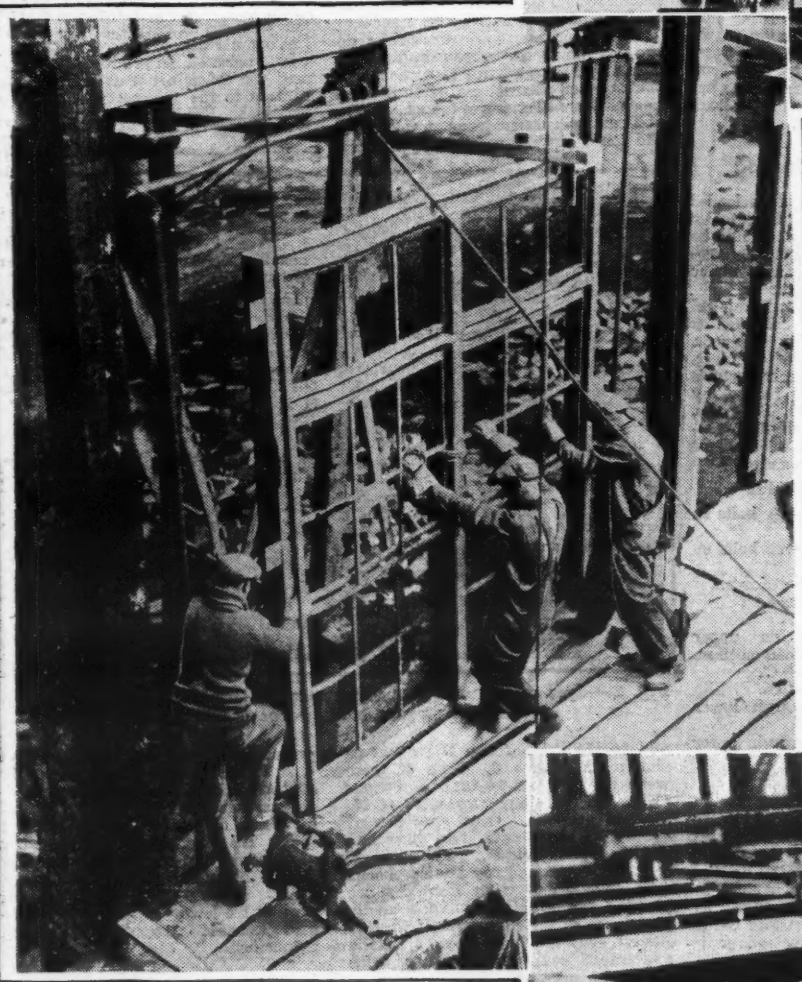
[1] Value of materials, supplies, and equipment turned over to water users.
[2] Preliminary work.
[3] Expenditures for new construction of Yuma auxiliary project made from the special fund established under the act of Jan. 25, 1917, known as the Yuma auxiliary fund.
[4] Difference between cost and sale price of unused materials, supplies, and equipment.
[5] Allowances to irrigation districts for prior water rights.

BUILDING "A NEW WASHINGTON"

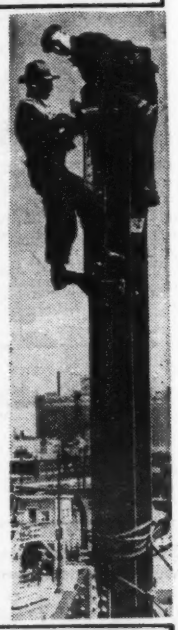
Construction of New Buildings to House Federal Departments in Nation's Capital Is Progressing

Ventilating ducts which the men at the right are helping to install in the new Department of Commerce building are so large that a small automobile might be driven through them. Sixty men, 700,000 pounds of sheet iron and 76 power-driven fans are required to complete the equipment which will provide pure and fresh air for the Government employes who will work in the huge building. Air will be modified in temperature after being brought into the building. Then it will be passed through sprays of water to cleanse it.

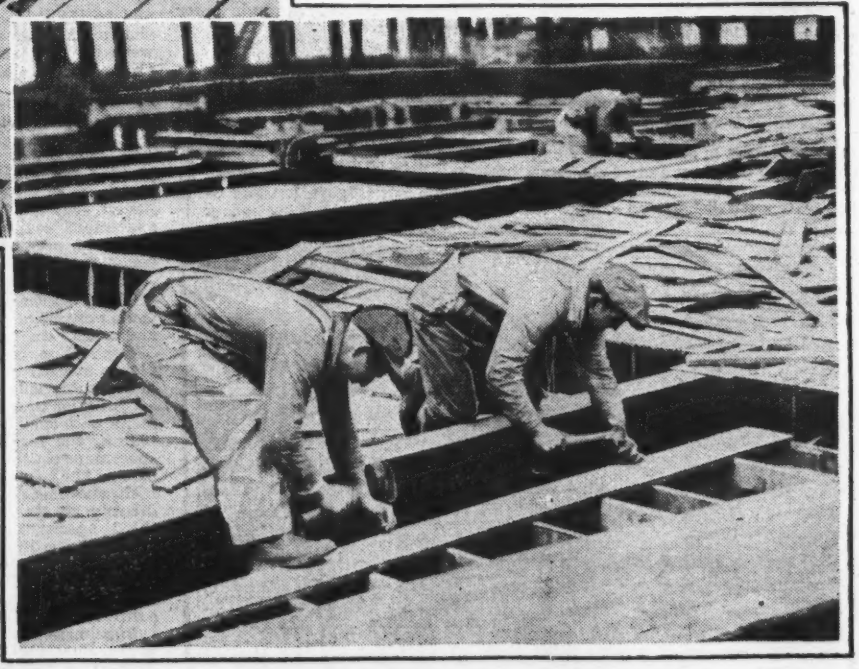




Installation of one of the 7,000 steel window frames being placed in the new Department of Commerce building is shown in the photograph at the left. The work proceeds with rapidity, only five minutes being required to place each window frame in position. The crew handling this operation finds each frame propped against the wall. The frame is lifted from that position by means of a derrick which is suspended from a heavy cable strung above the row of window openings in which frames are to be placed. The derrick is moved along the cable from window to window as the work proceeds.



The two carpenters shown at the right are laying a temporary flooring to serve as support for the permanent concrete flooring of the new Department of Commerce building. Forty men can lay the rough flooring in one story of one of the building's three sections in four days. Reinforcing wire mesh is laid on the wooden floor, then hollow tile are placed on the wire. The concrete then is poured and hardens after filling the hollow tile and the spaces around the structural steel.



TESTS OF WELDED COLUMNS

Extensive Study Follows Adoption of Welding Process In Erecting Structural Steel

The material here presented is incorporated in a report appearing in the March issue of the Journal of Research of the Bureau of Standards in the form of a report entitled "Transverse Tests of H-section Column Splices." Detailed diagrams and a technical analysis of data form a part of the report as it appears in the Bureau's publication.

By J. H. EDWARDS, H. L. WHITTEMORE, H. H. STANG
Bureau of Standards

STEEL structures are composed of large members, such as columns and floor beams, joined or fastened together with small plates, angles, or other shapes which are commonly referred to as structural details. The complex distribution of stress in the details requires that tests be made to show whether the methods used in determining the size of the details result in safe and economical structures. If, for some reason a detail is changed, further tests

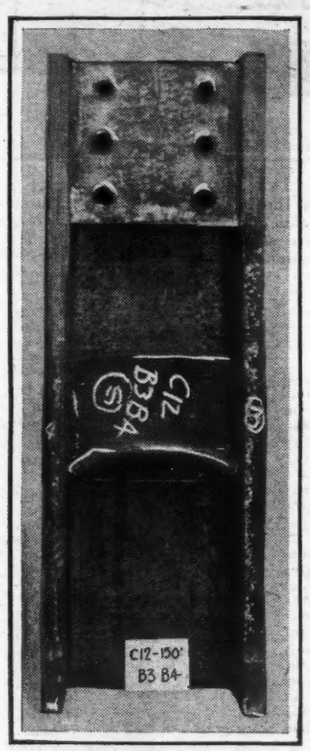


Fig. 1.—H section showing plate welded to inside faces of flanges at A

should be made to determine the effect of the change.

The adoption of welding in the fabrication and erection of structural steel has brought about the modification of many structural details. The present investigation was undertaken to determine the effect of substituting welding for riveting in the fabrication of details used in splicing columns of steel-frame buildings and of changing the location of the splice plates from a position parallel to the flanges of the columns to one parallel to the webs of the columns.

The columns of steel-frame buildings are commonly made in 2-story lengths and are connected at alternate floors by splices. The weight of the structure and its contents and the wind pressure against the structure produce compressive, bending, and shearing stresses in the columns and splices. At the column connections or joints, the splice plates joining the ends of the columns resist the bending and shearing stresses. The compressive stress at the joints is commonly assumed to be carried by the columns only. The stress is transferred from the upper to the lower column by bearing.

The tests reported in this paper were made to investigate the strength and other properties of welded splice connections of H sections subjected to bending. No tests were made to determine the resistance of this type of connection to shearing stresses.

Columns in steel-frame buildings are commonly 10, 12, or 14 inches wide. Data on the strength of splices of these sizes of columns were desired, using as few specimens as possible. As wind pressure on a building may produce loads on the columns in the direction of either of the transverse axes, it was necessary to test some specimens under loads parallel to one axis and other specimens under loads parallel to the other axis.

Designation Adopted

Because the specimens were loaded as simple beams, they will be called "beams" in this report. It should be remembered, however, that they represent spliced column sections under the action of bending stresses.

The American Bridge Co. furnished the specimens which were designed by James H. Edwards, chief engineer. O. E. Hovey, assistant chief engineer, and other members of the company's engineering staff assisted in making the tests. Prof. Elmer O. Bergman, research associate, contributed considerably to the analysis of the test data and edited the manuscript.

TABLE OF SYMBOLS

B_2=Force exerted by upper bolts on plate.
B_1=Force exerted by lower bolts on plate.
C=Resultant compressive force.
T=Resultant tensile force.
$N.\ A.$=Neutral axis.
C_1=Compressive force on upper flange of H beam at spliced section.
C_2=Resultant of B_2 and C_1
C_3=Resultant of W_2 and C_1.
W_2=Force exerted through lower weld on H beam.
W_1=Force exerted through lower weld on H beam.
S_t=Tensile stress.
S_c=Compressive stress.
S_s=Shear stress in bolts.
S_{sw}=Shear force per unit length in weld.

Plates were placed parallel to the webs of the H sections and welded to the inside faces of the flanges as shown at *A* in Figure 1. The welds for the 10 and 14 inch H sections with the exception of column C14–B3B2W, which had fillet welds, were single-bevel butt welds. The welds for the 12-inch H sections were 5/16-inch fillet welds. The distance from the ends of the plates to the ends of the H sections was ½ inch.

Angles welded to the H section at *B* in Figure 1 were used in an investigation of the strength of welded shelf angles which will be reported in a later paper.

Dimensions of Sections

The H sections were 3 feet long and 10, 12, or 14 inches wide. They were fastened together in pairs with either two or four splice plates bolted to the plates which had been welded to the H sections. The bolts were ⅞-inch in diameter and were placed in two rows parallel to the longitudinal axes of the H sections. The plates had 15/16-inch punched holes. One splice plate was placed outside the welded plates on each side of the specimens that had single splice plates. Two splice plates, one inside and one outside the welded plates, were used on each side of the specimens that had double splice plates. (Fig. 3.)

The properties and dimensions of the specimens are given in Table 1. The dimensions of the H sections are the nominal dimensions given in Carnegie Beam Sections (1st ed., 1927).

Four specimens were tested with the loads parallel to the splice plates and to the webs of the H sections as shown in Figure 3. Two of these were composed of 10-inch H sections (Fig. 2), the other two were of 14-inch H sections. One specimen of each size had single, the other had double splice plates. The same H sections were used for the specimens with single and with double splice plates, the specimens with single plates being tested first. It was believed that the behavior of 12-inch specimens could be predicted with sufficient accuracy for design purposes from the data on the 10 and 14 inch specimens.

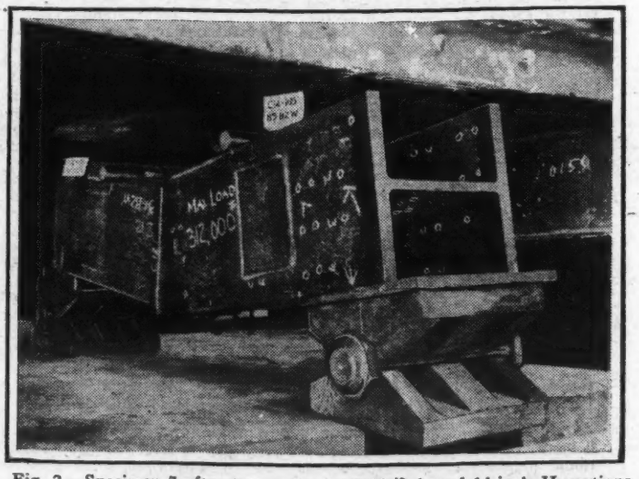


Fig. 2.—Specimen 7 after transverse test; 12-inch and 14-inch H sections with bearing plate, loads perpendicular to web.

Three specimens were tested with loads perpendicular to the splice plates and webs. One specimen consisted of 12-inch H sections and single splice plates and one of 12-inch H sections and double splice plates. Used in conjunction with the data from specimens with loads parallel to the splice plates, the results from these two specimens should give a good indication of the behavior of the 10 and 14-inch specimens under loads perpendicular to the splice plates. The third specimen in this group consisted of one 12-inch and one 14-inch H section with a bearing plate between and with single splice plates. It was included to show the effect of a difference in width of the H sections.

Specimens 1, 3, and 5 were tested in the Bureau's 600,000-pound capacity testing machine. Because of the larger loads required to produce failure, the other specimens were tested in the 10,000,000-pound capacity machine. The specimens were tested as simple beams on a 66-inch span with loads applied at the quarter points.

In the 600,000-pound machine the specimen was placed on 2½-inch rollers which were free to roll so as to avoid axial constraint in the specimen. A loading beam rested on 2-inch rollers, placed on the specimen at the quarter points. The spherical bearing block of the testing machine was applied to a 2-inch roller placed at the midspan of the loading beam.

The method of loading specimens in the 10,000,000-pound machine is shown in Figure 3. The pins in the end supports were 2½ inches in diameter and the rollers at the quarter points of the specimen were 2 inches in diameter. The lower platen of the testing machine has a spherical bearing which was adjusted at the beginning of a test to produce equal bearing on the rollers on the top of the specimen. No provision was made to eliminate axial constraint in these specimens. It was decided that the expense of providing the required number of rollers to permit longitudinal movement was not justified.

Wires were stretched on each side of the specimens between points directly over the supports as shown in Figure 3. The deflections of the specimens were obtained by observing the positions of the wires in a mirror having a scale attached. The scale was graduated in tenths of an inch and the deflection was read by estimation to the nearest hundredth of an inch. Readings were taken at 5,000-pound increments of load for specimens 1 and 5, and at 10,000-pound increments for the others.

A detailed account of the behavior of the specimens follows.

Specimen 1.—Ten-inch H sections, single splice plates, loads parallel to web. The splice plates failed in tension across the net section through one of the groups of holes nearest the middle of the plate. The failure began at the lower edges of the plates and extended progressively to the upper holes.

Ten-inch Sections

Specimen 2.—Ten-inch H sections, double splice plates, loads parallel to web. Figure 3 shows the specimen before testing, and Figure 4 shows it after testing. This specimen failed in the same way that specimen 1 did. The lower holes in the welded plates were badly deformed.

Specimen 3.—Fourteen-inch H sections, single splice plates, loads parallel to web. The splice plates scaled at a load of 218,000 pounds. The eight lower bolts in one of the H sections sheared.

Specimen 4.—Fourteen-inch H sections, double splice plates, loads parallel to web. Figure 5 shows the specimen after test with the splice plates in place, and Figure 6 shows it with one outer splice plate removed. The welded plates failed in bearing against the bolts. The holes elongated noticeably and one plate split between holes. The top and bottom

Fig. 3.—Specimen 2 before the transverse test; two 10-inch H sections; loads parallel to web.

welds of one plate on one side of the specimen failed. On the other side of the specimen the top weld of one plate and the bottom weld of the other failed. These weld failures occurred after the maximum load on the specimen had been reached. The lower rows of bolts started to shear. The webs of the H sections over the supports scaled, and the H sections were permanently bent and distorted.

Specimen 5.—Twelve-inch H sections, single splice plates, loads perpendicular to web. The welded plates and the splice plate on the lower side of the specimen deformed, as the deflection increased, so that the longitudinal axis of the plates approached the webs of the H sections. The welds in one of the H sections sheared for a length of 3 inches beginning at the inner end of the welded plate. The four bolts nearest the middle of the joint in this H section sheared.

Twelve-inch Sections

Specimen 6.—Twelve-inch H sections, double splice plates, loads perpendicular to web. Figure 7 shows the specimen after test with the bottom splice plate removed. Only one H section from specimen 5 could be used in this specimen as the lower welded plate of the other sheared. The 12-inch H section from specimen 7 was substituted. The welded plates on this section were longer and thicker and had two additional holes. Since the splice plates were symmetrical, these two extra holes were not used. The thinner welded plate on the lower side of the specimen failed in bearing against the bolts. The holes elongated and the plate sheared between the holes. The welds failed for a short distance beginning at the outer end of the plate. All the lower bolts started to shear.

Specimen 7.—Twelve-inch and 14-inch H sections, single splice plates, loads perpendicular to web, bearing plate between ends of H sections. The lower splice plate failed in tension on the net section through the holes nearest the end of the 14-inch H section.

A brief summary of the way in which the specimens failed is given in Table 1 on page 11.

The formula, $S=\frac{Mc}{I}$, should preferably be used to compute bending stresses in a beam only when the beam is long compared with its cross-sectional dimensions, the beam is constant in cross section throughout its length, and the bending stresses are below the proportional limit of the material. In these specimens the span of the beam was about five times the greatest cross-sectional dimension, which is below the values for which the common beam theory is applicable. There was a marked change in cross section at the splice, and the beams were loaded to failure.

The use of the beam formula for ultimate loads was analogous to its use in finding the modulus of rupture. Stresses computed from the ultimate load may be expected to hold closely for other specimens of the same size, shape, and loading, and approximately for those of similar size, shape, and loading. They should not be used as a basis for the design of widely different types of connections without further test.

For abrupt changes of cross section, such as occur in the neighborhood of the weakest section, there is no assurance that proportionality of stress to strain exists as was assumed in computing the bending stresses from their distance from the neutral axis determined according to the assumptions made in the analysis.

As the limit of proportionality of deflection to load was fairly definite for these specimens, the stresses corresponding to the "yield-point" loads can probably be used for design purposes because these stresses in the various parts of the spliced connection correspond to the maximum deflection to which the splice should be subjected. The stresses corresponding to the maximum loads are also given since these loads caused known changes in the specimens and the computed stresses serve as a criterion for determining the value of the analysis.

In developing a method of analysis which can be used in the design of details with complex stress distribution, assumptions such as these may give results that differ widely from the actual stress conditions in the specimen. Nevertheless, the analysis can be used in design if it gives values of stress which are consistent; that is, if for any type of failure the values of stress computed for specimens that failed are higher than those which were computed for specimens that did not fail. An ultimate value of stress for design of similar connections may then be set which is below the values at which failure occurred in the tests. In this investigation the stresses at which failure occurred were, with one exception, greater than the corresponding stresses at which there was no failure. For the exception the difference in the value of stress is less than 5 per cent. Moreover, the computed values at which failure took place are equal to or slightly above the ultimate strength of structural steel in tension, shear, and bearing so that these ultimate values may be used in designing similar connections.

The values of the compressive stresses in the H sections were low due to the short distance between the neutral axis and the extreme fibers.

Specimens 1, 2, and 7 failed by rupture of the splice plates in tension at computed stresses of from 68,600 to 83,200 lbs./in.^{2}. These computed stresses exceed the probable ultimate strength of the material in tension. A design based on an ultimate tensile strength of structural steel of 65,000 lbs./in.^{2} with a proper factor of safety should result in a splice of adequate strength in tension.

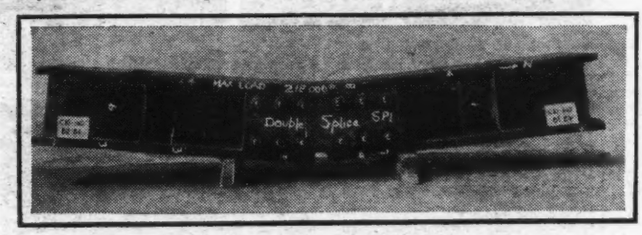


Fig. 4.—Specimen 2 after transverse test; 10-inch H section; double splice plates; loads parallel to web of H section.

Overcome by Stress

In two other instances the plates did not have sufficient strength to resist the stress to which they were subjected. The plates in specimen 5 bowed up as has been explained. In specimen 6 one welded plate sheared lengthwise. Based on the net area of a section through the bolt holes the shearing stress in this plate was 45,800 lbs./in.^{2}. It is evident that in the design of a connection the strength of the plates should be computed to insure that they will not fail as in specimens 5 and 6.

The bolts in specimen 3 sheared at a computed stress of 39,800 lbs./in.^{2}. In specimen 4, in which the splice plates failed in bearing, the bolts had commenced to shear at a computed stress of 40,100 lbs./in.^{2}. These values are probably somewhat in excess of the ultimate strength of rough bolts in shear. For purposes of design this may be taken at 32,000 to 35,000 lbs./in.^{2}.

Four bolts in specimen 5 sheared at a computed stress of 35,000 lbs./in.^{2}. The splice plate and welded plates on the lower side of this specimen bowed up. This produced shearing stress in the bolts at right angles to the shear considered in the analysis. The value of the resultant shear may well have been in the neighborhood of those shown by the other specimens that failed in shear. The fact that not all the bolts sheared favors this explanation since the bending of the plates with consequent transverse shear increased toward the middle of the splice plate.

Signs of failure in bearing in the splice plates occurred at average bearing stresses of 109,000 to 125,800 lbs./in.^{2}. Designs of similar joints on the basis of allowable stresses of 90,000 to 100,000 lbs./in.^{2} in bearing for structural steel should give splices of adequate strength.

In addition to shear and bearing, the bolts are also subjected to bending. In computing the bending stress in pins in pin-connected structures it is customary to assume that the loads on the pins are concentrated loads acting along the center line of the surface of contact. Since the thickness of the plates is only a small part of the arm of the forces, this method gives results which are sufficiently accurate. If the same method were used to compute the bending stress in the bolts in these specimens, relatively large errors would be introduced, since the moment arm of the forces would equal the thickness of one plate.

An exact analysis of the problem is not possible nor is it necessary. The bolt may be considered as a continuous beam on elastic supports under distributed load. The bending stress under such conditions will evidently be much less than if the same load is considered as concentrated and acting on a simple beam. Moreover, the effect of the nut on the bolt will be to reduce the bending, due to the loads applied to the bolt by the plates. Because of the uncertainty of any assumptions concerning the distribution of the loads on the bolts and on account of the absence of any definite indications of failure due to bending, no attempt has been made to analyze the bending stress in the bolts.

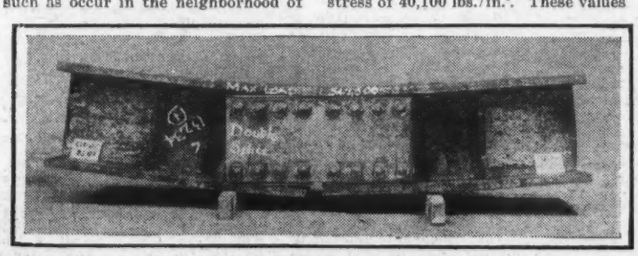
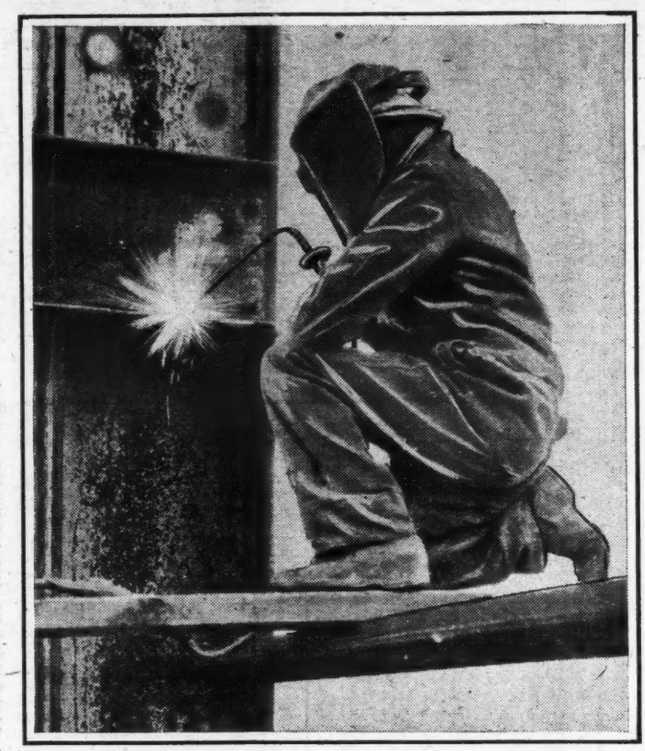


Fig. 5.—Specimen 4 after transverse test; 14-inch H section; double splice plates; loads parallel to web.



Ewing Galloway, N. Y.

Introduction of welding into the operation of erecting structural steel has created a demand for information developed by tests of column splices. The photograph reproduced above shows a welder at work on a large construction operation.

Under Heavy Load

Several welded seams of specimen 4 failed at a computed stress of 14,100 lbs./lin. in. after the maximum load on the specimen had been reached. The welds of specimens 5 and 6 failed for a short distance at the ends at average computed stresses of 7,000 to 11,800 lbs./lin. in., respectively. These weld failures were due to local concentration of stress at the ends of the welds after the specimens had begun to fail elsewhere. The computed weld stresses are, therefore, not indicative of the full strength of the welds. In no case did failure of the specimens begin in the welds. Welds designed according to the provisions of the code for fusion welding in building construction formulated by the American Welding Society should be adequate in strength.

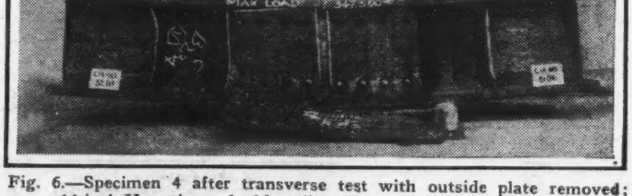


Fig. 6.—Specimen 4 after transverse test with outside plate removed; 14-inch H sections; double splice plates; loads parallel to web.

The load-deflection curves begin to deviate from a straight line at low values of load. This would indicate that portions of the connections were subjected to relatively high stresses at low loads with consequent redistribution of stress in the connections.

For specimens with loads parallel to the web there is a fairly close agreement between the observed values of deflection and the computed deflection of a beam similarly loaded and having a moment of inertia throughout its full length equal to that computed for the weakest section of the splice of the actual beam. The ratio of this moment of inertia to that of the H section varied from 0.13 to 0.30. There is no assurance, however, that this agreement would hold for other lengths of span and methods of load-

[Continued on Page 11.]

FOREIGN CONSTRUCTION NEWS

Reports Received by the Department of Commerce From Representatives Abroad

Many of the following items are summarizations of reports received by the Department of Commerce which contain information additional to that which is here presented. Reference numbers indicated in such items offer guidance to those who wish to address requests for further information to the machinery division of the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

CANADIAN PROJECTS

CONSTRUCTION in Canada continues at a high level as indicated by the following projects recently reported by Assistant Trade Commissioner L. A. France, Montreal: A 2-story garage and service station to cost $100,000, a warehouse to be five stories high, a new blue print plant storage and office building costing $100,000, a $200,000 apartment house, the installation of a sewage disposal system, cost of which is estimated between $14,000,000 and $20,000,000, an amusement pier to involve an outlay of $1,250,000 and new overhead railway crossings to cost about $280,000 at Toronton; the construction of a dam and a hydroelectric scheme at a total estimated cost of $6,000,000 in Montreal; a new brewery costing $250,000; a $1,000,000 office building at Ottawa, Ontario; a boiler plant to cost $1,000,000 at Gatineau, Quebec; the erection of a power house at a cost of $115,500 at New Westminster, British Columbia; an engraving plant costing $100,000, and a new fire alarm system to cost $109,500 at Hamilton, Ontario; a five-story office building at an expenditure of $250,000.

A new city reservoir for $375,000, and hydroelectric improvements costing about $2,000,000 at Winnipeg, Manitoba; a $1,000,000 Summer hotel at Montebello, Quebec; a new hotel to cost $100,000 at Dalhousie, New Brunswick; a motion picture theater to involve an expenditure of $400,000 and a new theater costing $225,000, at Vancouver, British Columbia; a $225,000 church for Quebec, Quebec; the construction of car barns to cost $250,000 at Hull, Quebec; a filtration plant at an approximate cost of $500,000 and a $500,000 power house at Niagara Falls, Ontario.

Repairs and extensions to pier and warehouse at a cost of $178,000 at Digby, Nova Scotia; a dredging scheme to cost about $100,000 at Rockwood, Manitoba; a $350,000 hydroelectric plant, and a hydroelectric development program to extend over a period of six years and to involve an expenditure of about $26,300,000 at Port Alberni, British Columbia; and the erection of a municipal stadium to cost about $100,000 at Saint John, New Brunswick. Further details on the foregoing projects may be secured under reference Canada No. 105140.

GDYNIA CONTRACTS

THE Polish minister of industry and commerce has signed an agreement with French and other concerns providing for the second part of the port of Gdynia construction program. The first part of the program, which is about to be finished, amounted to approximately 80,000,000 zlotys (1 zloty is worth approximately $0.1120). The second part, covered by the recent contract, will cost 48,465,861 zlotys. The new contract provides that the second part of the construction program be completed by Apr. 1, 1934. The most important undertakings under this contract include: The widening, dredging and extending of the port canal; construction of another internal basin, similar in all respects to the present Marshall Pilaudski Basin; dredging of a site for future shipyards; construction of a boulevard seawall to supersede present wooden structure; and dredging the port entrance to a depth of 12 meters.

After the second series is completed, as above, a third series of works will be undertaken in the outerpart of the port, i. e., in the area between the breakwater and former shore line. In addition the port authorities will construct storehouses and cranes while private enterprises will erect the port railroad passenger station and tunnel structures.

IN NEW ZEALAND

THE value of buildings, city and suburban, for which permits were issued by the Wellington city council last year amounted to £2,049,486, thereby placing the average value of building permits over the last three years above the £2,000,000 mark, states a report from Trade Commissioner Julian B. Foster, Wellington, New Zealand. This continued favorable activity in building construction in Wellington is a definite indication of the steady progress of the city, and a record well in advance of that of any other city in the Dominion.

A net decrease of £221,500 or approximately 8½ per cent in the value of building permits issued by the local authorities of Greater Auckland has been disclosed by figures for the year 1929. The computation shows that the number of new dwellings for which permits were granted was 1,186, or only one less than in the preceding year.

The total value represented under this heading was £1,052,000. The value of permits issued by the representative authorities in 1929, including permits for additions and alterations, has been shown as £2,384,559 in 1929 as compared with £2,605,986 in 1928. The figures show that on the whole building in Greater Auckland has been satisfactorily maintained during the past year. Although housebuilding has been described as quiet, living accommodation has been provided for an additional 4,000 people.

CANADIAN TERMINAL

WORK was recently commenced on that sections of the new terminal of the Canadian National Railways which lies southwest of the city between Turcot and Point St. Charles, according to a report from Trade Commissioner E. G. Sabine, Montreal, Canada. This work consists, in the main, of building subways at an estimated cost of approximately $2,500,000. The excavation work on the site of the central terminal station will commence about May 1, and other work such as construction of branch lines, grading, elevations, etc., will be started at the earliest time possible.

THEATER IN CHINA

A COMPANY has recently been formed in Hong Kong with an authorized capital of approximately $400,000 for the purpose of erecting a modern motion picture theater, states a report from Trade Commissioner A. Viola Smith, Shanghai, China. It is planned to construct a five-story building which will contain modern stores, office accommodation and a theater with a seating capacity of 1,200. Elevators for the dress circle and a modern air cooling system are some of the modern features to be offered to the theater going public. The estimated cost of the project is approximately $200,000. Further details may be obtained under reference China No. 105141.

RAILROAD IN POLAND

UNDER its budget for the fiscal year beginning Apr. 1, 1930, now on its way through the senate, the ministry of communications is allowed a sum of 35,000,000 zlotys (1 zloty is worth approximately $0.1122) for the construction of new railroad lines, according to a report from Assistant Trade Commission Gilbert Redfern, Warsaw, Poland. It is planned to use the entire appropriation for continuing the construction of the lines Bydgoscz-Gdynia, and Herby-Inowroclaw, Druja-Woropajewo, and Kalety-Podzamocza, as well as the building of additional junctions and switching facilities in Upper Silesia for expediting the movement of coal.

RECORD IN AFRICA

DURING the past year, the value of building permits granted for construction in Johannesburg and the immediate vicinity set an imposing record. The value of city plans was £3,258,148, while that for the Witwatersrand, the district neighboring the city, was £729,821. The number of permits issued for the city totaled 6,665. The high value of this construction was partly due to a number of large buildings which are being erected. The building of apartment houses and individual dwellings was also very active. The recession in general economic activity which has, so far in 1930, made itself felt in ordinary business, is not expected to be reflected in the value of the buildings planned for the new year.

THE UNITED KINGDOM

CONSTRUCTION projects in the United Kingdom, as recently reported by Acting Commercial Attache Donald Renshaw, London, include: The extension of the town hall to cost £100,000 at Hackney; the erection of 400 houses in Plumstead; 500 houses to be constructed in South Emsoll; about 200 houses at Chesterfield; over 500 houses at Kettering; the enlargement of a hospital at a cost of £75,000 in Birmingham; 2 motion picture theaters to cost £100,000 each at Liverpool.

Erection of medicinal and swimming baths to involve an expenditure of £50,000 at Cheltenham; a new police station, courts, and fire station costing in all about £100,000 at Southport; a £55,000 educational development scheme at Barrow-in-Furness; the heightening of the Thames flood banks to cost £500,000 at London; the expenditure of £230,000 for the extension of a wharf at Dundee; a dock extension plan to involve an outlay of £150,000 at Limerick; and the extension of the electricity supply system to cost £50,000 at Accrington. Further information in connection with the above may be obtained under reference United Kingdom No. 105073.

The following construction projects in the United Kingdom were recently reported by Acting Commerccial Attache Donald Renshaw, London: The erection of 140 houses at Edgeware; the expenditure of £116,526 for 304 houses in Bristol; a hospital to cost £60,000 at Lancaster; a motion picture and dance hall costing £130,000 in Sunderland; a new school for £57,000 at Sheffield; a £63,000 school at Chelmsford; a sewage purification scheme to involve an outlay of £78,326 at Coatbridge; a river wall to cost £114,729 at Liverpool; a bridge costing £1,750,000 at Hull; the extension of the electrical system to cost £150,000 in Nottingham. Further details on the foregoing may be secured under reference United Kingdom No. 104485.

LOANS IN LATVIA

THE demand for construction loans in Latvia is unusually large this year, states a report from Acting Commercial Attache Basil D. Dahl, Riga. The State Mortgage Banks, which is financing a great deal of municipal and private building in Latvia, is unable to supply the loans requested. The applications to this bank for construction loans aggregate 20,000,000 lats (1 lat is worth approximately $0.20) whereas the budgetary allocation granted for this purpose by the government amounts to only 5,000,000 lats. In view of the shortage of funds, it has been decided by the bank to limit the granting of loans to companies and individuals having buildings under construction at present. Such requirements amount to about 4,500,000 lats.

THE MODERN SCHOOL

[*Continued from page 1*]

astrous effects of a civilization that gives little opportunity for relaxation and wholesome recreation as an integral part of everyday life. The psychiatrist is showing what are some of the unfortunate psychological effects of starving the emotional life of children.

This means that the school in which children spend so much of their time must give the opportunity for the wholesome, happy expression of the emotional as well as the physical and mental sides of a child's nature.

In the attempt to meet the needs of city schools there has been a great deal of experimentation, and it is only within the past 20 years that there has come into existence what is known as "the modern school building," which is of a totally different type from those of any previous period. It contains not only classrooms, but shops, cooking and sewing rooms, nature-study rooms, library, drawing and music rooms, auditorium, and gymnasiums. Moreover, these facilities are found not only in high schools but in many instances in elementary schools.

In studying the modern school building, there are certain striking features which differentiate it from the buildings of the past. In the first place, a modern school building, —especially is this true of the elementary building because it is here that one finds the greatest departure from the traditional structures of the past—is planned on the basis of the educational program to be carried on in the building. A program, for example, must provide for play. This means that the modern school building must have one or two gymnasiums in addition to sufficient outdoor space for play, which also provides for physical education. Five acres is now considered to be the acres is now considered the minimum site for an elementary school plot.

In the second place, because city children need opportunity for training in handwork and similar creative work, and training in music, art, and the development of scientific habits, it is necessary to provide special rooms for these subjects. Especially is this true of the work-study-play or so-called platoon schools, with their nature study laboratories, art and music studios, geography, home economics, and similar rooms adapted to a particular specialized study, and workshops, and library. Each of these rooms has equipment appropriate to the study taught in it.

In the third place, the city child needs to develop habits of worthwhile use of his leisure time. Therefore, the modern city school has its auditorium, not a large barn-like structure echoing like an empty tomb held in reservation for 15 minutes a day and then abandoned, as was the kind formerly constructed, but an auditorium so arranged that it will seat only about one-fourth or one-third of the school enrollment and equipped with both artistic and architectural advantages and devised for constant use throughout the school day. Usually the auditoriums have inclined floors with upper seats, a stage deep enough to accommodate dramas, appointed adequately and with a cyclorama or Shakesperean velvet semicircular curtain, footlights, floorlights, dressing rooms, and other necessary stage equipment. In such an auditorium, children see and hear good plays, have advantages of concerts, lectures, and productions prepared and presented by the children themselves, not occasionally as was the characteristic of the school programs of the past generation, but frequently, and in many schools every day. Radio broadcasts from the best concerts, for example, are brought direct to the students of music in an atmosphere and under building conditions and a program of education so arranged as to afford the widest opportunity for the development of habits of appreciating the best kind of music. So it is with the other fine arts.

Some of the modern schools are so designed architecturally so as to afford constant use of all facilities by pupils at all hours of the day. Under such a system a school building gives utmost service without being forced to bear the economic losses occasioned when classrooms, gymnasiums, auditoriums or other spaces are vacant. Thus it is possible to supply a seat for every child when he needs it and also the special facilities noted above at a cost that is no greater than that required to supply classrooms only under the traditional plan.

FROM NORTH TO SOUTH

Michigan-Florida Highway Gives Proof of Economic Values of Good Roads

The following article is issued by the Bureau of Public Roads of the Department of Agriculture.

THE scenic and much-used road known officially as United States Route No. 41 is one of the finest products of highway construction by the State and Federal Governments. It extends from Copper Harbor on Lake Superior, the most northern point in Michigan, to Naples, Fla., located on the Gulf coast of the southern State. It is improved and paved throughout practically its entire length of 1,951 miles.

This important highway passes through a densely populated and highly industrialized section. In the eight States through which it runs are centered 23 per cent of the population of the United States and 20 per cent of the wealth of the country. These facts amply testify to the economic importance of this major artery of traffic.

A Tourists' Favorite

Leading from the vast mid-western area to the semitropical region in the extreme southeastern section of the country, Route 41 is a tourists' favorite and thus is a definite aid to the relaxation and recreation of many thousands of persons each year.

A brief description of the territory which this road serves gives definite evidence of the part which a major highway plays in the industrial and social life of the Nation.

The highway offers a variety of scenery from the north woods of Michigan and Wisconsin to the palms and gayly colored flowers of Florida; it passes through industrial and railroad centers, and through Chicago, the metropolis of the Middle West; through rich copper, iron and coal mining regions and through large lumber and tobacco sections. For a great portion of the way, it traverses agricultural, dairy and livestock regions and fruit-growing sections. It connects a popular playground of the North with hunting and fishing along its lakes with well-known Winter resorts in the South noted for water sports and fishing. In Winter the journey from its northern to its southern terminus is a passage from a land of ice and snow to a summerland of perpetual warmth and sunshine.

Route 41 traverses a country rich in historic interest, peopled early by French settlers in the North and by French and Spanish settlers in the South. It begins in the land of the Indian in Michigan, crosses what was originally Indian territory for its length, and ends in the land of the Seminoles, in Florida. It passes through or skirts sections where lived in greatest numbers those ancient Americans, the Mound Builders. Through Tennesse and Georgia, it stretches through a region of considerable campaign activity in the Civil War.

Crosses Portage Paths

In Michigan, Wisconsin, Illinois, and Indiana, Route 41 crosses many of the portage paths of such early explorers as Nicolet, Radissou and Groseilliers, Joliet and Marquette, LaSalle, LeSueur and Perrot, and Allouez, and later by Lewis and Clark, and the Hunt party on their way to the Far West. In Kentucky and Tennessee, it traverses a part of the old Transylvania territory explored by Daniel Boone, James Robertson, Richard Henderson, George Rogers Clark and the Long Hunters. In Nashville, Tenn., it crosses the famous old Indian trail, the Natchez Trace; and in Macon, Ga., the path of de Soto. At Tampa, Fla., it touches upon ground explored by the Spanish adventurers, de Narvaez and de Soto.

Federal aid has played an important part in the improvement of the route, especially in the construction of the higher-type pavements. Of the total length of 1,951 miles, 737 miles, or 38 per cent, have been improved with Federal aid, at a total cost of $20,771,337, of which the Federal Government paid $9,633,458, or 46 per cent.

Across the Peninsula

Starting at Copper Harbor, Route 41 crosses the upper peninsula of Michigan, dotted with hundreds of lakes, and known as Hiawatha Land, made famous by Longfellow's poem. The peninsula is noted for its rich copper and iron mines.

The route passes through Houghton, on Portage Lake, the seat of the Michigan College of Mines, one of the world's great mining engineering and technological schools. Across the point of the lake and Portage Canal is Hancock, on whose high hills are the shafthouses of the Quincy, the oldest Michigan copper mine still in production. The highway follows the shores of Portage Lake, skirts Keweenaw Bay, and continues through L'Anse, located on the site of an old Chippewa Indian village. L'Anse is in a lumber district and is the home of a Ford lumber mill. South and eastward the route passes through Ishpeming and Negaunee, on its way to Marquette. Ishpeming is in the heart of the Marquette iron range. In and around the city are many deep shaft and open-pit iron mines.

Marquette is a picturesque Summer resort on a bluff above Lake Superior, and an important iron-ore shipping center for northern Michigan and Wisconsin. Named for the missionary Marquette, it was the scene of early pioneer activity of French fur traders and missionaries.

From Marquette, the highway continues south through a wooded, farming and mining section, crossing United States Highway No. 2 at Powers, and then extends to Menominee, on Green Bay.

Green Bay territory is rich in early French history and Indian lore. As early as 1634, 14 years after the landing of the Pilgrims, Jean Nicolet, the fur trader, came here, looking for a passage to China. He found the Menominee Indians, an Algonquin tribe, living at the mouth of the Menominee River. Nicolet was followed by Radissou and Groseilliers, Joliet and Marquette, by LeSueur and Perrot, and by Pere Claude Alloues. The Menominee Indian nation long occupied the shores of Green Bay, fighting the Sioux, Sacs and Foxes to the west and south, and the Chippewas to the north. Louis Chappieu, a French trader, established a trading post in Menominee in 1799.

Joined to Menominee, by a number of bridges over the Menominee River, is Marinette, in Wisconsin, a growing Summer resort with a fine harbor, large lumber interests and extensive lake commerce.

Traverses Wisconsin

In Wisconsin, Route 41 passes through Oconto to Green Bay, the oldest city in the State, and built on the site of an ancient Indian village. Green Bay was the meeting place for Indian tribes and traders, and is in a territory where Pere Claude Allouez established his missions.

Augustine and Charles DeLanglade, the first white settlers in Wisconsin, came to Green Bay in 1745, and built their trading posts within the present city limits. Joliet and Marquette stopped there on their way to the Mississippi River in 1673. The city today is an industrial town and a shipping center for large quantities of grain, and cheese and other dairy products.

From Green Bay, the highway follows the Fox River through Appleton, where it intersects United States Route 10. Appleton, situated on high bluffs above the river, is located in a rich dairy and livestock region. The city has large industrial resources, chief of which is the paper industry, and utilizes power developed in the Fox River by Government locks.

Traversing the fertile Fox River valley, the route continues to Oshkosh, on the western shore of Lake Winnebago, one of the largest and most beautiful of Wisconsin lakes, and noted for its yachting, ice-boating, fishing, and hunting. Oshkosh is located on an old mission site, and has many beautiful parks. It is one of the important mound centers of the State.

The highway continues through hilly farming country to Fond du Lac at the southern extremity of Lake Winnebago. The city is a trade center for Summer residents.

Milwaukee, the metropolis of the State, is the next important city to be reached.

Passes Through Chicago

From Milwaukee, the highway continues south and enters Illinois, passing through and near a number of beautiful suburban towns until it reaches Evanston, the location of Northwestern University. From Evanston Route 41 follows the famous Sheridan Road, Lake Shore Drive, and Michigan Boulevard, and the South Park System through Chicago, metropolis of the Middle West, and the intersecting point of three transcontinental highways, Nos. 41, 20, and 30.

Leaving South Chicago, Route 41 soon enters Indiana, and follows its western border through level farming land, passing through Hammond, two miles south of which is the Hammond-Ford airport, on through Attica and Rockville to Terre Haute, the metropolis of the Wabash Valley. The city is in the heart of bituminous coal fields, and is the intersecting point for United States Highways Nos. 40 and 41.

From Terre Haute, the highway parallels the Wabash River through a rich farming section to Vincennes, the oldest settlement in the State, and, with the exception of Detroit, Mich., and Kaskaskia, Ill., the oldest in the territory comprised in the States of Ohio, Michigan, Illinois, Indiana, and Wisconsin. The city is located in a rich agricultural region surrounded by coal fields, and is the intersection of United States highways Nos. 41 and 50.

Route 41 continues through Princeton, where are located coal mines and oil and gas wells, to Evansville, an industrial city in a coal-mining region on the Ohio River, with abundant water power supplied by a large Government dam.

Crossing the Ohio, the highway enters the agricultural, coal-mining and tobacco-growing State of Kentucky, and passes through Henderson, Greenville, and Hopkinsville, all located in the western part of the State.

Henderson, founded in 1797, one of the oldest cities along the Ohio, has a large tobacco export market. Within the city limits are three coal mines. It is the intersecting point for United States highways Nos. 41 and 60.

Leaving Hopkinsville, Route 41 enters Tennessee and traverses the central portion of that State, through

[Continued on Page 10]

Snow and laboring lumbermen are familiar sights in Michigan, where "Route 41" has its northern terminus

Bureau of Public Roads photos.

Near its southern end, "Route 41" is flanked by long rows of royal palms.

FIVE THOUSAND SHOVEL TYPES

Needless Multiplicity of Designs Eliminated by Application Of Simplified Practice by Manufacturers

By J. F. McNEIL
Division of Simplified Practice, Bureau of Standards

WHILE there are no statistics on the subject, it is safe to estimate that half of the world's workers do their daily tasks with either a pencil or a shovel. Moreover, there is a surprisingly precise individual taste in these two tools. Most people have a decided preference as to type, style, etc.—but there were more than 5,000 varieties of shovels. That was approximately the possible variety prior to 1923. In that year the manufacturers decided to undertake a program of simplification designed to eliminate, as far as possible, the waste caused by unnecessary diversity. They felt that their purpose could best be effected through the concerted action of manufacturers, distributors, and users acting in cooperation with the division of simplified practice of the Bureau of Standards, Department of Commerce.

A simplified practice committee was appointed by the manufacturers to make a survey of the production and sales records with a view to the establishment of a simplified schedule. The data thus secured were used in preparing definite recommendations which were submitted for discussion at the first general conference held at Atlantic City, N. J., Oct. 19, 1925. Here the manufacturers' program as applied to the simplified list of multiples and sizes was adopted, and at the same time action was taken with regard to finishes and grades.

The New Arrangement

Under this plan the new grade A took the place of the former grade A, and the new grade B took the place of the old grade B, and the new grade C supplanted what were formerly grades C and D. With regard to finishes the conference unanimously voted to eliminate all finishes except black on all items with the exception of molders' shovels, in which the finishes were limited to black and full polished. A modification of this program was necessary, however, because, due to the opposition of some to the elimination of polished finishes, it was impossible to secure signed acceptances from 80 per cent of the production capacity of the industry.

A second general conference was held at the Department of Commerce, Washington, D. C., Apr. 29, 1926. This conference reaffirmed the recommendation of the previous conference as applied to multiples, sizes, and grades. It was the consensus of opinion that there existed an unnecessary diversification of finishes and that it would be desirable and feasible to eliminate those for which there was little demand. A resolution was unanimously adopted, recommending that the industry, through the standing committee, work toward the elimination of as many of these finishes as possible.

A standing committee composed of representatives of manufacturers, distributors, and users was created to maintain contact between the industry and the division of simplified practice and to determine the adequacy of the recommendation through an annual review.

Selection of Date

July 1, 1926, was selected as the date on which this recommendation should become effective.

On June 15, 1927, the standing committee unanimously recommended the addition of two types of shovels to the then existing schedules, the total reduction in variety being from 5,000 to 2,178, or 57 per cent. The success of the original program on grades and sizes prompted the manufacturers' representatives to place before the entire committee a proposal to include a section on finishes. This section was adopted, and now appears in the revised edition of the recommendation, which became effective July 1, 1927, and which was subsequently reaffirmed by the standing committee May 28, 1928.

A survey of production, conducted prior to the committee's latest meeting, showed that at that time more than 96 per cent of the shovels, spades, and scoops were being made in conformity with the simplified-practice recommendation.

After the simplification had been in effect for about a year the Department of Commerce requested a statement from the acceptors of the program as to the accruing results. The following are excerpts from some of the replies:

"On account of the simplified-practice program our inventories have been substantially decreased," said a large eastern manufacturer of shovels. "The service which we have been able to render our customers has been decidedly increased and economies have been effected all along the line.

Expressions of Favor

"Our customers have expressed themselves as quite favorable to the project and our program is believed to be very much worth while."

"The present program as adopted by the manufacturers of shovels, spades, and scoops," another manufacturer reported, "has now been in effect since July 1, 1926, and during that period up to date has proven most satisfactory, and unquestionably has tended to reduce the manufacturers' cost by reason of the elimination of so many odd sizes and grades, which elimination represents about 5 per cent of the sales volume."

A distributor of plumbers', steam fitters', and mill supplies and tools wrote: "We have already noticed a great benefit. We formerly used to carry a surplus stock of these items which did not move quickly and now, as many of these various types and patterns have been eliminated, we can readily see that it is going to effect a big saving in the course of a year."

"We have noticed a much smaller invoice in shovels," a hardware dealer in the Mid-west replied.

"We are strictly in favor of the continuance of your program, and feel that the benefits will become greater and greater as time goes on."

"The sizes which we are using have been included in the simplified practice, or at least the sizes of the rough sheets from which the finished product is made are those that were adopted as standards," the purchasing agent of one of our large railway systems said. "We are in sympathy with the efforts which your department has made to bring about simplified practice, and if the manufacturers call attention to any special sizes that we are ordering, suggesting standard sizes instead, we will be very glad to endeavor to change our requirements to permit the purchase of these standard sizes."

Tangible Benefits Derived

It is apparent from the foregoing quotations that tangible benefit is being derived from the application of the simplified-practice recommendation. The outstanding benefits recorded are: Reduction of inventory, release of storeroom space, less capital tied up in a slow-moving stock, quicker deliveries, and an increase in turnover.

Simplified Practice Recommendation No. 48, Shovels, Spades, and Scoops, can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 5 cents a copy.

FROM THE NORTH TO THE SOUTH

[*Continued on Page 9*]

territory explored by Daniel Boone and the Long Hunters.

On its way to Nashville, Route 41 passes through Clarksville, a great tobacco market, named for George Rogers Clark, hero of many campaigns in the Revolutionary and Indian wars. Picturesque Dunbar Cavern is three miles from the city.

A boulder in the city marks the famous Natchez Trace, an old Indian trail of the Chickasaws and Choctaws. In 1801, the Federal Government entered into a treaty with these Indian tribes to lay out, open and make a convenient wagon road through their lands extending from settlements in Mero district in Tennessee to those of Natchez in Mississippi territory. The road practically followed the old Indian trail, and became known as the Old Natchez Road. It was about 200 miles long. For more than 30 years it was the principal overland thoroughfare between north and south in the Mississippi valley, and was the main factor in populating and upbuilding the interior.

In Notable Environment

In Centennial Park is the Parthenon, a replica of the old Grecian structure in Athens, which when completed will house a collection of paintings. "The Hermitage," plantation home of Andrew Jackson, is some 10 miles east of the city.

Nashville was settled in 1780 by a company of pioneers under James Robertson and Col. John Donelson, whose daughter became the wife of Andrew Jackson.

Between Nashville and Chattanooga is Murfreesboro, an educational and industrial center, noted for its red-cedar market. Near by is Stone River Battlefield, the site of a national cemetery.

Chattanooga is picturesquely situated on Moccasin Bend, a sharp turn in the Tennessee River, with Signal Mountain to the northwest, Missionary Ridge on the east, and Lookout Mountain to the south, the latter commanding magnificent views of five States. From Chattanooga Route 41 continues over hilly country and through a productive agricultural region passing through Dalton and Cartersville, Ga., to Atlanta, the capital and largest city of Georgia. Situated at the foot of the Blue Ridge Mountains, it is a great educational, railroad, financial and manufacturing center.

Leaving Atlanta, Route 41 passes through rolling fruit and cotton-growing country to Macon, in the Georgia peach belt. Lying in the foothills of the Piedmont plateau, Macon is surrounded by miles of peach and pecan trees and rich farming lands. It is a city of wide streets, many trees and stately old mansions. It is the intersecting point for United States Routes 41 and 80.

The highway continues through Perry, Tifton, and Valdosta into Florida. There it traverses a level farming and wooded section and crosses the Suwannee River, made famous in song, on its way to Lake City, where it intersects United States highway No. 90, known as the Old Spanish Trail.

Leaving Lake City, Route 41 passes through Gainesville and Ocala, situated in the highlands of north-central Florida. Gainesville is the center of the new tung-oil industry, with over 1,000,000 Chinese tung trees, and is a shipping point for garden produce, citrus and other fruits. Gainesville is also the home of the State university. Ocala, a charming city of homes, has rows of stately and majestic oaks heavily draped with Spanish moss bordering its streets. Here such bright colored flowers as the poinsettias, petunias, begonias, roses, and hibiscus abound.

Continuing down the west coast of Florida, the highway, on its way to Tampa, passes through the citrus-growing and gardening section of Inverness. Tampa, at the head of old Tampa Bay, is a port of entry and a famous Winter resort, noted for tarpon fishing. It is also an industrial town of large cigar manufacture and phosphate production and shipment.

From the city excellent paved roads lead in all directions, along rivers and lakes and thorugh green hammock lands where gnarled cyprus, bay and magnolia trees are covered with yellow jasmine and wild-grape vines. In Ybor City, Tampa's Latin quarter, are still practiced the old Spanish, Italian and Cuban customs.

Follows the Waterfront

A boulevard follows the waterfront of the three branches of Tampa Bay from Gandy Bridge to Davis Islands, passing old, colonial homes and Ballast Point, with its mile-long fishing pier. On the Pinellas Peninsula, west of Tampa, and easily reached over paved highways, is Tarpon Springs, with its labyrinth of picturesque bayous within the city limits, the home of an interesting Greek colony and America's largest sponge industry.

Clearwater is a typical Winter resort on Florida's highest coast elevation. St. Petersburg is a famous Winter resort in a sub-tropical setting. The city is a shipping point for fish, fruit, and Winter vegetables.

From Tampa, Route 41 continues south over the old Tamiami Trail through Bradenton, a resort city, noted for its commercial farm gardens, citrus groves, poultry, and dairying; and through Sarasota, on the Gulf coast with a deepwater harbor and municipal docks. It continues through Venice and Punta Gorda, noted for pineapples, citrus, and other tropical fruits and vegetables, to Fort Myers, the City of Palms, on the banks of the Caloosahatchee River.

Below Fort Myers is Naples, well-known for its beautiful shrubs, flowers and palms. Here Route 41 connects with United States highway No. 94, running through the Everglades, a sparsely-settled, marshy region, and the home of the Seminole Indians, to Miami, on the Atlantic coast. From Miami, an excellent paved road runs south over the Florida Keys, connects with a ferry for a distance of some 40 miles, and continues to Key West, from which Cuba is easily reached by ferry and boat.

Highway Costs In New Jersey

ROAD maintenance costs in New Jersey averaged $1,118.18 per mile last year, a reduction of $41.66, according to a report by Alex W. Muir, superintendent of maintenance of the State highway department. The cut was attributed to modern construction methods and the use of more substantial materials.

Every classification of pavement, except macadam, was said to show a decreased unit cost. The single exception was explained in the report as due to the high maintenance charges on the temporary macadam paving placed on the Holland Tunnel route between Elizabeth and Newark and in Jersey City. Macadam was adopted for the sections named pending settlement of the fill made across the meadow land.

A table prepared by Mr. Muir placed the maintenance costs for concrete at $779 a mile. For bituminous concrete on a stone base the charge was $1,727 a mile and for the same type of surface on a concrete base $888 a mile. Gravel surfaces required the expenditure of $848 a mile and bituminous macadam $5,611. Brick paving necessitated an outlay of $1,007 a mile and dirt, cenders and other materials $251.

The State system of roads now totals 1,294 miles, the report disclosed, 1,069 of that total calling for maintenance last year and the remaining 225 being under construction or taken over by the State for construction. The increase in the roads under maintenance was 134 miles.

Plans for Capitol

AUTHORITY has been given Governor Huey P. Long, of Louisiana, by the State board of liquidation, to employ an architect for the purpose of drawing up plans for a new State capitol building to be constructed in Baton Rouge at a cost of $1,250,000.

License System In California

[*Continued from Page 2.*]

pair of individual groups who spent their time between the pages of books, and who were not to be trusted economically, or trusted with good judgment. They were considered, however, to be more honest than the contractor, but their judgment was felt to be bad and they were deemed to be so technical it wasn't safe to follow them. They were thought to be the natural enemy of the contractor.

Times have changed. Today the contractor and the engineer sit down together with a great deal of mutual confidence, but they still do not do it enough. And the same thing is true with the architect and the contractor.

Paragraph four provides:

"Licenses may be cancelled for willful and deliberate disregard or violation of the building code of the State, or any political subdivision thereof, or of the safety laws, or the labor laws of the State."

Insurance a Factor

In other words, the contractor who bids without compensation insurance, and saves from 4 per cent to 25 per cent on his labor, cannot compete in California. He must carry compensation insurance or his license will be cancelled. Contractors with bad records often have a 30 per cent or 40 per cent handicap on dangerous work on their labor charge alone, due to their compensation record. Therefore, proper compliance with safety laws and proper safety record, will reduce their bidding average; it gives them a leeway of anywhere from 4 per cent to 20 per cent on jobs that require some element of danger.

The willful and deliberate disregard or violation of building codes by those who are willing to bid on small buildings on the chance of being able to "skimp" and thereby make profits will not be permitted.

Force also will be brought against operators of the type who approach inexperienced persons possessing lots, get them to mortgage their lots for enough money to build a building, start construction and, after getting the work two-thirds completed and receiving three-fourths of the money, "skip out" on the job.

The registrar, on receiving complaints, holds a hearing and renders a decision. If that decision is not satisfactory to the parties concerned they may appeal for a rehearing. If the rehearing is granted the decision must be rendered in a short time, and upon that decision, if they are not satisfied, their next appeal is to the superior court.

The registrar is charged with the full administration of the law and its enforcement. And, in order to reduce the complications of administration, the director of the Department of Professional and Vocational Standards is made the registrar.

The registrar may return a suspended license at any time upon sufficient showing that, within his discretion, he thinks it is justified to be returned. But if a license is cancelled it cannot be returned within one year, and then only upon a showing of rectification of all the harm done, or all of the loss incurred, due to the cause of the complaint, and then within the discretion of the registrar.

The superior court may overrule the registrar and return a license upon appeal thereto.

I have quoted the penalty for violation of the act. There is a sentence that we are, at the present time, studying very seriously. We haven't emphasized it as yet. But with a little legal advice I expect to emphasize it. That sentence is:

"That the same penalties shall apply, upon conviction, to any member of a copartnership, or to any construction managing or directing officer, or of any organization consenting to, participating in, or aiding or abetting any such violation of this act."

In other words, I construe that to mean that an owner who knowingly contracts with an unlicensed contractor for work is aiding, abetting and participating, and can be arrested and brought into court; that any material dealer, insurance company, any bond company, who renders service to an unlicensed contractor comes under that same provision or penalty for participating and aiding and abetting.

TESTS OF WELDED COLUMNS

[*Continued from Page 7.*]

ing or for other ratios of moments of inertia. For specimens with loads perpendicular to the web, the actual deflection of the specimens was from 50 to 100 per cent greater than that of beams with a constant moment of inertia equal to that of the splice. The ratio of the moment of inertia at the weakest section of the splice to that of the **H** section varied from 0.56 for the 14-inch **H** section of specimen 7 to 1.03 for specimen 6.

In an actual structure the column connections are not only subjected to bending stresses, but are also called upon to assist in transferring direct loads from one column to another. The relative magnitude of the stresses due to direct load and bending will depend among other things on the size and shape of the building and the position of the column in it. In these connections, considered as simple beams, the maximum compressive stresses are small. Considering the column under the action of both types of loading, the compressive stress becomes of major importance and the column may be expected to fail in compression before the ultimate strength of the connection in bending is reached.

The splice will also be subjected to forces which cause bending and shearing of the splice. Transverse shearing of the splice is resisted by the frictional force developed between the ends of the columns and by the shearing stress developed in the splice plates. When the direction of the forces causing shear is perpendicular to the plane of the splice plates, local bending in the plates and tension in the bolts may also be produced. The stresses thus developed should be considered in connection with those caused by bending of the splice.

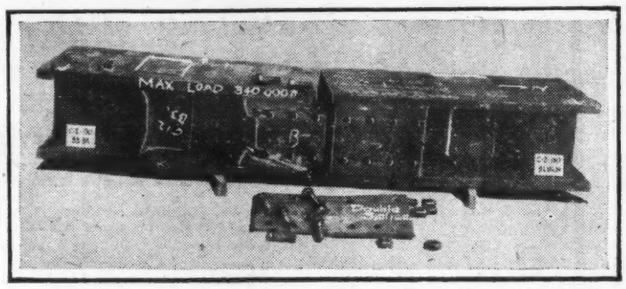


Fig. 7.—Specimen 6 after transverse test with lower splice plate removed; 12-inch H sections; double splice plates; loads perpendicular to web.

The conclusions formed from tests of steel columns consisting of **H** sections 3 feet long and 10, 12 and 14 inches wide, connected with splice plates bolted to plates welded between the flanges of the **H** sections, and tested as simple beams with equal loads at the quarter points of a .66-inch span are:

1. The analysis of stress in these specimens using the simple beam theory gives maximum stress values in the connections which are consistent with the ultimate strength of structural steel.

2. Similar column splices having adequate factors of safety may be designed by these methods on the basis of the values of stresses prescribed by standard building codes for structural steel.

	Specimen number													
	1		2		3		4		5		6		7	
H section	10 inches, 140 lbs./ft.		10 inches, 140 lbs./ft.		14 inches, 165 lbs./ft.		14 inches, 165 lbs./ft.		12 inches, 150 lbs./ft.		12 inches, 150 lbs./ft.		(12 inches, 150 lbs./ft. (14 inches, 165 lbs./ft.	
Welded plates, size.....inches	7¾ by ⅜ by 9		7¾ by ⅜ by 9		12 by 7/16 by 12¾		12 by 7/16 by 12¾		9 by ⅜ by 9¼		(9 by ⅜ by 9¼ (12 by 7/16 by 9¼		12 by 7/16 by 9¼ 12 by 7/16 by 12¾	
Splice plates, size.....do	7½ by ⅜ by 19		7½ by ⅜ by 19		11½ by 7/16 by 25		11½ by 7/16 by 25		8 by ⅜ by 19		8 by ⅜ by 19		8 by 7/16 by 27	
Splice plates.....number	2 (single)		4 (double)		2 (single)		4 (double)		2 (single)		4 (double)		2 (single)	
Splice plates.....position	Vertical		Vertical		Vertical		Vertical		Horizontal		Horizontal		Horizontal	
Bolts.....total number	24		24		32		32		24		24		32	
Bearing plate, size.....inches													14½ by 2 by 15½	
Moment of inertia.....in.⁴	84		141		357		583		367		617		427	
Failure	Splice plates failed in tension.		Splice plates failed in tension, welded plates showed signs of bearing failure.		Bottom rows of bolts sheared, in one H section.		Welded plates failed along lower line of bolts, welds sheared, bolts starte. to shear.		Plates bowed up, 4 inner bolts sheared, and welds failed at inner end on one H section.		Failed in bearing, welded plate sheared lengthwise, welds pealed up near ends.		Lower splice plate failed in tension.	
	Load at—		Load at—		Load at—		Load at—		Load at—		Load at—		Load at—	
	Yield point	Maximum	Yield point	Maximum	Yield point	Maximum	Yield point	Maximum	Yield point	Maximum	Yield point	Maximum	Yield point	Maximum
Load.....pounds	30,000	102,450	60,000	218,000	70,000	270,950	220,000	547,500	55,000	216,670	130,000	340,000	60,000	312,000
Bending moment.....lbs.-in.	247,500	845,200	495,000	1,798,500	577,500	2,309,000	1,815,000	4,516,900	453,800	1,787,500	1,072,500	2,805,000	495,000	2,574,000
Maximum tensile stress in splice plates.....lbs.-in.²	21,200	72,500	22,900	83,200	17,000	68,000	20,200	72,700	14,200	55,750	18,600	48,600	13,200	68,600
Maximum compressive stress in H section.....lbs.-in.²	4,700	16,000	7,900	28,600	4,400	17,500	11,900	29,550	4,100	16,100	7,000	18,400	4,000	20,900
Shearing stress in lower bolts.....lbs.-in.²	8,900	30,400	9,100	33,000	10,000	39,900	16,100	40,100	8,900	35,000	11,700	30,600	7,200	37,500
Bearing stress on lower bolts and plates.....lbs.-in.²	16,300	55,500	33,200	120,500	15,600	62,300	50,600	125,800	16,200	64,000	41,700	109,000	11,300	58,000
Shearing stress in lower welds.....pounds per linear inch	1,500	5,420	3,200	11,500	1,790	7,170	5,780	14,100	1,800	7,000	4,800	11,800	1,400	7,800

Table 1.—Dimensions of specimens and results of tests.

Memorial Road

[*Continued from Page 3.*]

of plans which have been laid for the building of the road. Trees in the approach area which are to remain after the construction work is completed have been tagged. Others have been uprooted and transplanted along the right-of-way. The privet hedge has been removed to Hell Hole, a swampy stretch of land southwest of the mansion house, and will be replanted. Desirable top soil is being stripped and placed in convenient storage piles for replacement on the subgrade after the grading operations have been completed.

A Unique Feature

The highway as it approaches Mount Vernon has been designed to fit around many of the larger and more valuable trees which will be protected by planking or boarded walls so that they will not be injured during the course of construction work.

The course of the highway, designated as the Mount Vernon Memorial Highway, begins at Columbia Island, situated in the Potomac River at a point opposite the Lincoln Memorial. At that point it is connected with the Memorial Bridge which spans the river.

Crossing Columbia Island and Boundary Channel Bridge, the route will pass under a bridge embodying one of the most attractive systems of grade separation ever designed. The bridge will have four ramps, permitting easy flow of traffic in as many directions and entirely eliminating left hand turns.

The route then follows the rolling ground of Virginia, passing the ruins of Abingdon, the birthplace of Nellie Custis, adopted daughter of Martha and George, and the home of the Stuarts. The house was recently destroyed by fire. Next is Four Mile Run, to be spanned by a bridge and a fill, where Washington purchased ground in 1775 and surveyed it in 1785.

The course then follows the Alexandria Canal, engineered and constructed by Washington, and passes through the town of Alexandria. It continues to a fill and bridge at Hunting Creek and to Wellington, Va., where Tobias Lear, Washington's secretary lived. Two or three estuaries of the Potomac are crossed, one of which is Hunting Creek where Washington, in the company of his cronies, hunted fox. Across Hunting Creek is the Mansion House farm, surmounted by the house in which Washington lived from 1747 to 1779. The house will stand, upon completion of the road, as a thoroughly appropriate marker at the terminal of a modern "lane" created in memory of the man who once was master there.

Wood Utilization

THE National Committee on Wood Utilization of the Department of Commerce will hold its annual meeting on May 2 at 9:30 a. m. in the Department of Commerce Building, Washington, D. C. Secretary of Commerce R. P. Lamont, the committee's chairman, will deliver the opening address, says an announcement by Axel H. Oxholm, the director of the committee.

While the general subject for discussion at this meeting will be the projects of the committee, special attention will be devoted to its activities in the building and construction field.

The committee is compesed of 200 members representing more than 80 trade associations interested in intelligent utilization of wood.

Lumber for Japan

TWO hundred forty million board feet of Russian lumber will be imported into Japan in 1930, if a preliminary agreement between the Soviet and Japanese governments recently reported to the lumber division of the Department of Commerce by Assistant Trade Commissioner Howard B. Titus, of Tokyo, is consummated.

The agreement, according to Mr. Titus, calls for the sale of 75 per cent of this lumber through one of the largest lumber concerns in Japan, and the balance by the Soviet government. The Japanese firm will advance 70 per cent of the current market price when the lumber is shipped, and will pay the balance after it is sold. This new agreement, according to advices, supersedes the former agreement between the Japanese government and another Japanese firm.

Mr. Titus also reports that the Soviet government is said to have sold 12,000,000 board feet of white aspen for match stock in Japan, delivery of this stock to start after Apr. 1.

While the exact figures on imports of Siberian softwoods into Japan for 1929 are not yet available, preliminary reports show that, including aspen, these imports are less than those of 1928—199,361,280 board feet. These reports also indicate that, if present negotiations are successful, these imports will show an increase in 1930 of 41,000,000 board feet over 1928.

Japanese importation of softwoods from Asiatic Russia, according to Japanese official figures, rose from 112,226,000 board feet in 1926 to 196,990,000 board feet in 1927. Imports of aspen in 1926 and 1927 were approximately the same. According to trade figures, imports of aspen into Kobe, Japan, by a prominent lumber company, increased from 16,770,000 board feet in 1927 to 18,012,000 board feet in 1928, and in the first half of 1929 amounted to 9,666,000 board feet.

Construction

The importance laid upon construction as an influence in restoring industrial balance has not been over-emphasized, says the President's business survey conference.

The keen interest in this great industry, the insistent demand for more news of its developments, wider coverage of its activities and, above all, speed in carrying this news to its readers, have brought to The United States Construction Magazine an enthusiastic national response.

The home builder, the home owner, the architect, the engineer and the business man, and everyone whose affairs are closely linked with the construction world, are now receiving this new magazine as a special section of The United States Daily on alternate Saturdays.

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